Review Article

Effects of Physical-Agent Pain Relief Modalities for Fibromyalgia Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Purpose. We conducted a systematic review and meta-analysis to investigate the effects of the following physical-agent modalities for pain relief in fibromyalgia (FM) patients. Methods. We identified randomized controlled studies of adults with FM in the MEDLINE, CINAHL, and PEDro databases. The primary outcome measure was pain relief measured by a visual analogue scale (VAS), and the secondary outcome measures of interest were subjective improvements in the number of tender points, Fibromyalgia Impact Questionnaire (FIQ), and quality of life (QOL) scores. Results. Eleven studies were included in our review. The studies’ physical-agent modalities were low-level laser therapy (LLLT), thermal therapy, electromagnetic field therapy, and transcutaneous electrical nerve stimulation (TENS). LLLT did not reduce VAS scores, but it significantly reduced both the number of tender points and FIQ score. Thermal therapy was associated with significantly reduced VAS scores, tender points, and FIQ scores. Electromagnetic field therapy was associated with significantly reduced VAS score and FIQ score. TENS significantly reduced VAS scores. Conclusion. Our analyses revealed that thermal therapy and LLLT had a partial effect on pain relief in FM patients, and this beneficial effect may have a positive influence on FM patients’ health status.

1. Introduction

Fibromyalgia (FM) is an idiopathic, common, and complex syndrome, defined as long-lasting, widespread, and symmetrical nonarticular musculoskeletal pain with generalized tender points at specific anatomical sites [1, 2]. The pain that individuals with FM experience interferes with their performance of activities of daily life (ADLs) and results in a decreased quality of life (QOL) [2–5]. There are many possible treatments for FM that can be classified as pharmacological and nonpharmacological therapies [6–8]. The authors of a 2014 meta-analysis reported that very few drugs in well-designed clinical trials have demonstrated significant relief for multiple FM
symptom domains, whereas nonpharmacologic treatments with weaker study designs have demonstrated multidimensional effects [8]. Nonpharmacological therapies such as physical exercise including strength training, aerobic training, and yoga [9, 10] and multicomponent therapy interventions [11, 12] have been used for FM. Physical-agent modalities are defined as passive treatments such as thermotherapy, cryotherapy, massage, electrotherapy, laser treatment, and others are nonpharmacological interventions used for FM patients [10]. Even though several placebo-controlled trials assessing the effects of physical-agent modalities on pain, ADLs, and QOL in patients with FM have been published in recent years, some studies had small sample sizes and have presented controversial results. A further elucidation of the effects of each physical-agent modality for FM is needed. We conducted the present study to systematically review the effects of physical-agent modalities for the treatment of FM, especially for the improvement of pain, ADLs, and QOL.

2. Methods

2.1. Search Strategy. We performed electronic searches of three databases—MEDLINE (the US National Library of Medicine bibliographic database), CINAHL (the Cumulative Index to Nursing and Allied Health Literature), and PEDro (the Physiotherapy Evidence Database)—up to February 28, 2017. A primary search with the term “fibromyalgia” was combined with the following terms: “cryotherapy,” “icing,” “low-level laser,” “laser therapy,” “electrostimulation,” “TENS,” “electrotherapy,” “magnetic therapy,” “ultrasound,” “ultrasonic,” “thermotherapy,” “heat therapy,” “thermal therapy,” “shortwave,” “microwave,” “hot pack,” “wrapping,” and “traction,” and secondly, with “randomized controlled trial.” Reference lists of included articles were scanned for additional citations. The full search strategy is available upon request.

2.2. Study Criteria and Selection. Studies were included if (1) the participants were fibromyalgia patients; (2) the design was a randomized controlled trial (RCT) including crossover designs, published in peer-reviewed journals; (3) treatment using physical-agent modalities was compared with a pure control or placebo; and (4) the full text was available. Five independent reviewers screened the titles and abstracts of all retrieved citations for eligibility. Full-text articles were retrieved for review when they showed potential inclusion criteria or when there was insufficient information in the abstract and title to make a decision. Disagreements regarding selected articles were discussed between reviewers until a consensus was achieved, or a fifth reviewer was included to reach a majority decision. This systematic review is in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

2.3. Outcome Measures. The primary outcome measure was pain relief. The criterion that we used for the study’s measurement of pain intensity was that the pain intensity had to be measured by a visual analogue scale (VAS) at the baseline and again after treatment. The secondary outcome measures of interest were subjective improvements in the number of tender points, the score on a Fibromyalgia Impact Questionnaire (FIQ), and the score for quality of life (QOL). The FIQ measures physical functioning, work status, depression, anxiety, sleep, pain, stiffness, fatigue, and well being. The studies’ patients’ QOL had to be measured by the Short Form 36 Health Survey (SF-36), Health Assessment Questionnaire (HAQ), or Arthritis Impact Measurement Scale (AIMS).

2.4. Data Extraction. The goal of our data extraction was to determine the differences between the studies’ treatment groups regarding the mean outcome differences before and after treatment, and the standard error of these differences. The data were extracted independently by five investigators. The following data were extracted from each included study: participant demographics, the study design, the interventions, and the evaluation methods used for each group.

In studies in which multiple periods of treatment for pain were set, we analyzed the data for the longest period. In studies in which pain (as measured by a VAS) was treated in multiple body parts, the data for the part that had the strongest pain were analyzed. For the study’s analysis, we required the mean difference between the baseline and the final data and the standard deviation of that difference for each group of subjects. When the required data were not described in studies, we calculated the mean difference and standard deviation using the study’s data as described [13, 14]. Studies in which the required data could not be calculated were excluded.

2.5. Evaluation of the Studies’ Methodological Quality. Two independent reviewers performed a quality assessment of each study by using the PEDro scale (Physiotherapy Evidence Database, 1999). This scale has shown good reliability for scoring RCTs [15]. The PEDro scale consists of 11 items related to scientific rigor. The scale’s items 2 to 11 contribute to internal validity, and the study is given 1 point for each of these items that is met. The first item relates to external validity and is not included in the final score. The quality assessment was performed independently by the two reviewers, and any disagreement was discussed until consensus was reached.

2.6. Data Synthesis and Analyses. We performed the meta-analysis using Review Manager software, ver. 5.0 (Copenhagen, The Nordic Cochrane Centre, the Cochrane Collaboration, 2008) to determine whether the treatments using physical-agent modalities decreased the FM patients’ pain. Outcomes were analyzed as continuous outcomes using a fixed-effect model to calculate the weighted mean difference and 95% confidence interval (95% CI). A p value ≤ 0.05 indicated significance for an overall effect. Heterogeneity was investigated using the chi-square test, and a p value ≤ 0.05 was accepted as significant. Subgroup analyses were also performed according to the physical-agent modalities.

3. Results

3.1. Database Search and Study Selection. Figure 1 illustrates the different stages of the search and the selection of studies.
included in our review. The initial search of the three
databases identified 227 titles and abstracts, of
which 30 were retrieved for full-text review. When
the exclusion criteria were applied, 11 studies satisfied the
criteria to be included in this review [16–26]. The main reasons
for exclusion were as follows: (1) outcomes of the pain scale
were not reported or (2) the interventions and the compar-
ison groups did not include a control group.

3.2. Quality Assessment of the Included Studies. A detailed
description of the 11 studies’ PEDro scores is shown in
Table 1. Seven studies [17, 18, 21–23, 25, 26] showed a PEDro
score >5, two studies [16, 17] scored 5, and the remaining
two studies [19, 24] scored 4. The most frequent omissions
in the studies were the lack of blinding of therapists (10
studies). The allocation of patients was not described in
sufficient detail to ascertain whether the allocation was
concealed in the randomization method (eight studies), and
an “intention to treat” analysis was applied for least one key
outcome (eight studies).

3.3. Characteristics of the Studies’ Participants. The charac-
teristics of the participants of the 11 studies are summarized in
Table 2. The total number of participants was 498. Because
two studies [23, 26] had a double treatment design, 28
subjects were excluded in this meta-analysis. The total
number of participants included in the meta-analysis was
thus 470. The treatment groups comprised a total of 236 FM
patients and the control groups were a total of 234 partic-
ants. Detailed demographic data were not reported in all
studies, but the majority of the participants were adults; one
study [22] did not report the ages of the participants. The
male:female ratio varied among the five studies [19–23], and
the other six studies included only female participants
[16–18, 24–26]. All participants (including the control group
subjects) were patients with FM.

3.4. Characteristics of the Studies’ Interventions and Physical-
Agent Modalities. The interventions (i.e., the physical-agent
modalities) applied in the 11 studies are summarized in
Table 2. The most common intervention was low-level laser
therapy, used in five studies [16, 21, 22, 24, 26]. Thermal
therapy (which included balneotherapy, mudpack, and
thermal bath) was used in four studies [16, 18–20]. TENS
[23] and pulsed electromagnetic field therapy [25] were used in
one study each.

The intervention protocols varied among the studies. The
amplitude and irradiation density of the LLLT
[16, 21, 22, 24, 26] were, respectively, applied to the tender
dpoint and the trigger point from 28 sec to 3 min. In thermal
therapy [16, 18–20], the temperature ranged from 30°C to
45°C, and the adaptation time was from 10 to 30 min; several
studies used 20 min. The TENS [23] was applied for 20 min,
2×/day for 7 days, and the intervention conditions were
200 μsec, 2 and 100 Hz, and 60 mA. Pulsed electromagnetic
field therapy [25] was applied for 30 min, 2×/day for 7 days,
and the intervention condition was 40 μT, 0.1–64 Hz.

3.5. Effects of Interventions

3.5.1. Pain (as Measured by VAS). Six of the 11 studies
evaluated the participants’ pain by means of a VAS and were
included in the meta-analysis. Figure 2 illustrates the mean
difference and 95% CI values for pain relief as measured by
VAS in these six studies for the physical-agent modalities
LLLT, thermal therapies, TENS, and electromagnetic field
therapy. The five studies’ LLLT was not associated with the
reduction of pain compared with the control group (mean
difference: −4.00; 95% CI, −23.4 to 15.4, p = 0.69). In
contrast, the TENS (−23.00; 95% CI, −43.28 to −2.72,
p = 0.03), the electromagnetic field therapy (−30.30; 95% CI,
−35.19 to −25.41, p = 0.0001), and thermal therapy (−29.74;
95% CI, −37.29 to −22.19, I² = 75%, p = 0.02) were associ-
ated with a significant reduction of VAS score compared with
the respective control group.

3.5.2. The Number of Tender Points. Six studies evaluated
pain by evaluating the number of tender points and were
included in the meta-analysis. As illustrated in Figure 3, the
LLLT (−2.21; 95% CI, −3.51 to −0.92, I² = 42%, p = 0.0008)
and thermal therapy (−5.71; 95% CI, −7.26 to −4.31, I² = 0%,
p < 0.00001) were both associated with a significant re-
duction of the number of tender points compared with the
control group.

3.5.3. The Fibromyalgia Impact Questionnaire (FIQ) Score. Ten
studies evaluated the FIQ score and were included in the
meta-analysis. As shown in Figure 4, electromagnetic field
therapy (−24.80; 95% CI, −31.23 to −18.37, p < 0.00001),
LLLT (−4.35; 95% CI, −6.69 to −2.01, I² = 62%, p = 0.03),
and thermal therapy (−24.67; 95% CI, −28.94 to −20.39,
I² = 84%, p = 0.0004) were all associated with a significant
reduction of FIQ score compared with the control group.

3.5.4. Quality of Life (QOL). Two studies evaluated the
participants’ QOL and were included in the meta-analysis.
The LLLT as evaluated by SF-36 demonstrated no significant
difference compared with the control group (5.80; 95% CI,
−0.93 to 0.33, p = 0.35, AIMS: −0.40; 95% CI, −1.67 to 0.87,
p = 0.54).

4. Discussion

Fibromyalgia is defined as chronic pain, tenderness, and
pain amplification [1, 27]. Increased levels of inflammatory
cytokines and changes in neurotropic growth factors in the
central nervous system and peripherally may influence the
development and maintenance of central pain hypersensi-
tivity by affecting adaptation and neuroplasticity [28–30].
The chronic painful lesions of fibromyalgia lead to limita-
tions of activities of daily life and have been very difficult to
treat effectively.
Fibromyalgia is characterized by a clinical syndrome whose primary symptoms include chronic widespread pain [1], and nonpharmacological options for fibromyalgia-induced pain may be as important as pharmacological treatment. Our meta-analysis revealed that TENS, electromagnetic therapy, and thermal therapy had positive effects on fibromyalgia-induced pain. These positive effects of nonpharmacological treatment may be due to physiological and biochemical changes in fibromyalgia patients. In two studies [23, 31], one of which was part of the present meta-analysis, the application of a TENS device improved pain relief in FM patients, and the effectiveness was suggested to be derived from a reduction in leukocyte migration, local action at peripheral opioids, and a decrease in local inflammatory reaction in the painful muscles. Low-frequency pulsed electromagnetic field therapy may improve pain in fibromyalgia patients, and several factors might mediate the therapeutic effects, such as alteration in pain perception, increases in the pain threshold and hormone levels, the inhibition of inflammatory edema, and vascular changes [25, 32]. Notably, only one RCT for TENS and one RCT for electromagnetic field therapy were identified. A further accumulation of RCT data regarding the effects of TENS and electromagnetic field therapy on fibromyalgia is needed.

Ardic et al. [16] indicated that balneotherapy can effectively treat patients with fibromyalgia by relieving their clinical chronic pain, and they proposed that the suppression of inflammatory mediators with balneotherapy is related to its beneficial effect. Studies that examined hyperthermia showed that balneotherapy with mudpack and hot-pool

<table>
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<th>Study (year published)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
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<th>9</th>
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<td>Ruaro et al. (2014)</td>
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Figure 1: The different phases of the search of the three databases and the selection of the studies included in the present analyses.

Table 1: Detailed description of PEDro scores.
treatments described a pain-relieving effect, which may be explained by a mitigation of muscle tone, increase in the pain threshold in the nerve endings, and/or peripheral vasodilation [19, 20, 33].

Tender points were defined by the American College of Rheumatology criteria, which is the standard method for evaluating tenderness in fibromyalgia patients [34]. Our meta-analysis showed that the LLLT and thermal therapy were effective treatments for tenderness in fibromyalgia patients. That is, although Armagan et al. indicated that the numbers of tender points in their LLLT and placebo groups were not significantly different [17], the other two studies showed that the patients’ tender point numbers decreased after LLLT [21, 24]. Our meta-analysis showed favors plot in LLLT group and that LLLT was thus an effective therapeutic method to reduce the number of tender points in FM patients. However, our meta-analysis indicated that LLLT did not effectively reduce the patients’ VAS pain scores. On the other hand, three of the 11 studies in our meta-analysis that evaluated balneotherapy showed tender points’ count was significantly different between the treatment group and nontreatment group, in addition to decrease in pain.

<table>
<thead>
<tr>
<th>Study (year published) [ref.]</th>
<th>Participants</th>
<th>Age (intervention, control, or placebo group)</th>
<th>Modality</th>
<th>Treatments</th>
<th>Evaluation</th>
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<tr>
<td>Ardic et al. (2007) [16]</td>
<td>24 women with FM</td>
<td>43.5 ± 10.2, 48.8 ± 8.9</td>
<td>Balneotherapy 30°C, 20 min</td>
<td>Once daily, 5 days/wk for 3 wks, whole body; control</td>
<td>Pain (VAS), NTP, algometric score, FIQ, BDI, serum PGE2, LTb4, and IL-1 levels</td>
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<td>Armagan et al. (2006) [17]</td>
<td>32 women with FM</td>
<td>38.9 ± 4.9, 37.6 ± 5.9</td>
<td>Low-level laser therapy 50 mW, 830 nm, 1 min each tender point</td>
<td>Once daily, 5 days/wk for 10 days; control</td>
<td>NTP, morning stiffness, VSGI, FIQ, and total myalgia score</td>
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<td>Bagdatli et al. (2015) [18]</td>
<td>70 women with FM</td>
<td>45.2 ± 9.1, 42.8 ± 9.6</td>
<td>Balneotherapy and mudpack 38°C, 20 min and 45°C, 20 min</td>
<td>10 times within 2 wks, whole body; control</td>
<td>PGASC, IGASC, FIQ, pain, fatigue, sleep, stiffness, anxiety, depression, and BDI</td>
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<td>Evcik et al. (2002) [19]</td>
<td>42 patients with FM</td>
<td>42.0 ± 6.8, 41.5 ± 7.1</td>
<td>Balneotherapy 36°C, 20 min</td>
<td>Once daily, 5 days/wk for 3 wks, whole body; control</td>
<td>Pain (VAS), FIQ, NTP, and BDI</td>
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<td>Fioravanti et al. (2007) [20]</td>
<td>80 patients with FM</td>
<td>46.2 ± 10.5, 48.6 ± 9.4</td>
<td>Mudpack and thermal bath 40°C–45°C, 10 min and 37°C–38°C, 15 min</td>
<td>Once daily, for 2 wks, whole body; control</td>
<td>FIQ, VAS (headache, fatigue, sleep disturbances), NTP, HAQ, and AIMS</td>
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<td>Gür et al. (2002) [21]</td>
<td>50 patients with FM</td>
<td>30.4 ± 6.9, 28.5 ± 6.3</td>
<td>Low-level laser therapy 2 J/cm², 3 min each tender point</td>
<td>Once daily, 5 days/wk for 2 wks; placebo</td>
<td>Pain, NTP, skinfold tenderness, stiffness, sleep disturbance, muscle spasm, fatigue, and FIQ</td>
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<td>Gür et al. (2002) [22]</td>
<td>40 patients with FM</td>
<td>—</td>
<td>Low-level laser therapy 11.2 mW, 3 min each tender point</td>
<td>Once daily, 5 days/wk for 2 wks; placebo</td>
<td>Pain, NTP, skinfold tenderness, stiffness, sleep disturbance, muscular spasm, and fatigue</td>
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<td>Lauretti et al. (2013) [23]</td>
<td>39 patients with FM</td>
<td>32 ± 8, 35 ± 8</td>
<td>TENS 200 μsec, 2 and 100 Hz, 60 mA, 20 min</td>
<td>Twice a day, for 7 days; placebo</td>
<td>Pain (VAS), daily analgesic consumption, quality of sleep, and fatigue</td>
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<td>Ruaro et al. (2014) [24]</td>
<td>20 women with FM</td>
<td>43.4, 39.4</td>
<td>Low-level laser therapy 20 mW, 670 nm, 7 s × 4 for 18 trigger points</td>
<td>3 times/wk for 4 wks; placebo</td>
<td>NTP, FIQ, McGill pain questionnaire, and VAS</td>
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<td>Sutbeyaz et al. (2009) [25]</td>
<td>56 women with FM</td>
<td>43.0 ± 9.6, 40.9 ± 6.9</td>
<td>Pulsed electromagnetic field therapy 40 μT, 0.1–64 Hz, 30 min</td>
<td>Twice a day, for 3 wks, whole body; control</td>
<td>PIQ, pain (VAS), BDI, SF-36, and PGART</td>
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<td>Vayvay et al. (2016) [26]</td>
<td>45 women with FM</td>
<td>36.4 ± 8.3, 38.0 ± 8.4</td>
<td>Laser therapy 2 J/cm², 3 min each trigger points</td>
<td>Once daily, 5 days/wk for 3 wks; placebo</td>
<td>Pain (VAS), body flexibility, FIQ, SF-36, and BDI</td>
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</table>

VAS: visual analogue scale; NTP: no. of tender points; BDI: Beck’s depression index; FIQ: Fibromyalgia Impact Questionnaire; PGE2: prostaglandin E2; LTb4: leukotriene B4; IL: interleukin; VSGI: global improvement as reported on a verbal scale; PGASC: patient’s global assessment score; IGASC: investigator’s global assessment score; HAQ: health assessment questionnaire; AIMS: arthritis impact measurement scale; HDRS: Hamilton depression rate scale; DSM: diagnostic and statistical manual of mental disorders; SF-36: 36-item short form health survey; PGART: patient’s global assessment of response to therapy.
By contrast, LLLT may be ruled unfit to widespread pain of fibromyalgia patients because of narrow range of effective irradiated area. In the case of short-term treatment, LLLT may fail to decrease pain intensity in some painful areas, and then VAS in the patients remain persistently high. For this reason, LLLT may be more effective for decreasing the number of tender points than reducing the pain intensity. The therapeutic mechanism underlying LLLT remains to be elucidated in further studies.

The Fibromyalgia Impact Questionnaire (FIQ) comprised ten items in a self-administered instrument that measure physical functioning, work status, anxiety, pain, fatigue, sleep, depression, stiffness, well being, and evaluates activities of daily living (ADLs) in fibromyalgia patients [35]. EULAR guidelines emphasized that the goals of treatment are to improve the quality of life, maintain function (functional ability in everyday situations), and reduce symptoms [36]. In our meta-analysis, electromagnetic field therapy, LLLT, and thermal therapy were all associated with a significant reduction of the FIQ score. Three RCTs

### Table 1: Comparison of Pain Relief as Measured Using a VAS

<table>
<thead>
<tr>
<th>Study of subgroup</th>
<th>Experimental</th>
<th>Control</th>
<th>Mean difference</th>
<th>IV, fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal therapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: not applicable</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 2.22 (P = 0.03)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Electromagnetic field therapy</td>
<td></td>
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<tr>
<td>Subtotal (95% CI)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: not applicable</td>
<td></td>
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</tr>
<tr>
<td>Test for overall effect: Z = 12.14 (P &lt; 0.000001)</td>
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<tr>
<td>Low-level laser therapy</td>
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<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: not applicable</td>
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<tr>
<td>Test for overall effect: Z = 0.40 (P = 0.69)</td>
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</tbody>
</table>

### Figure 2: The mean difference and 95% CI of pain relief as measured using a VAS in 6 of the 11 studies for the physical-agent modalities: LLLT, thermal therapies, TENS, and electromagnetic field therapy.

<table>
<thead>
<tr>
<th>Study of subgroup</th>
<th>Experimental Mean</th>
<th>Experimental SD</th>
<th>Control Mean</th>
<th>Control SD</th>
<th>Mean difference</th>
<th>IV, fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal therapy</td>
<td></td>
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</tr>
<tr>
<td>Subtotal (95% CI)</td>
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<tr>
<td>Heterogeneity:</td>
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<tr>
<td>Test for overall effect: Z = 3.34 (P = 0.0008)</td>
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</tbody>
</table>

### Figure 3: The mean difference and 95% confidence interval (CI) of tender points for physical-agent modalities.
indicated that thermal therapy, including balneotherapy, mud baths, and mudpacks, had a positive effect on the FM patients’ FIQ score, suggesting that thermal therapy alleviated fibromyalgia-induced pain, and the improvement of fibromyalgia symptoms thus had a positive effect on the FIQ total score [10, 11, 13]. On the other hand, three of the five RCTs of LLLT reported that LLLT did not effectively reduce the FIQ score. Fibromyalgia-induced pain was not significantly changed in our meta-analysis, and this noneffectiveness may have led to the unchanged FIQ score. In addition, Bennett et al. suggested that a 14% change in the FIQ total score is clinically relevant [37]. In the results of LLLT, change in the FIQ total score is small compared with the clinically relevant value. Therefore, the positive effect of LLLT for fibromyalgia patients is smaller compared with thermal therapy and may be definite for the treatment of fibromyalgia.

Regarding the quality of the studies’ evidence, although the PEDro score in nine studies was >5 (max. score = 9, min. score = 4), all nine studies were small-scale (the largest treatment group consisted of 40 participants). The intervention period in all nine studies was short (max. treatment period of 4 weeks). The quality of evidence according to Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) for all outcomes of efficacy, tolerability, and safety was low, downgraded for the reasons given in the following description of study limitations.

The limitations are as follows. First, our review used only the MEDLINE, CINAHL, and PEDro databases for the search for studies, and we selected only English-language publications for the meta-analysis. We also selected only studies that included a pure control group or placebo groups (i.e., no other intervention). There are few reports on each physical-agent modality for fibromyalgia, and the heterogeneity analysis revealed a high score in the meta-analysis. Our meta-analysis did not evaluate the total effect of all of the physical-agent modalities since we searched for each modality’s effect. Finally, the RCTs did not provide much data regarding the patients’ QOL, and our search was thus unable to reveal adequate findings about posttreatment QOL in fibromyalgia patients. These restrictions are tasks to address in future studies.

5. Conclusions

In summary, our findings suggest that thermal therapy has a positive effect on fibromyalgia-induced pain, tender point, and FIQ. Thermal therapy is a more effective physical-agent modality for fibromyalgia patient treatment. Effect of electromagnetic therapy and TENS for the treatment of FM on pain intensity was observed. However, there are few reports on these physical-agent modalities. We speculate that this effectiveness has underlying mechanisms involving both the central nervous system and the peripheral nervous system. Clinically, nonpharmacological treatment for peripheral organization in fibromyalgia patients is important, and physicians need to consider both central and peripheral tissue as therapeutic targets.

Conflicts of Interest

The authors declare that there are no conflicts of interest to disclose regarding the publication of this article.

References


