Intramuscular and periosteal acupuncture in patients suffering from chronic musculoskeletal pain – a controlled trial

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Abstract

Background Periosteal acupuncture has shown promising results in clinical practice. The aim was to compare three patient groups: one with intramuscular acupuncture, one with periosteal acupuncture, and a third information control group, with respect to clinically relevant pain relief, physical functioning and intake of analgesics in patients with chronic musculoskeletal pain in the neck or low back or both. We reported the psychological changes in these patients in a previous issue of this journal.

Methods 144 consecutive patients with nociceptive pain for >3 months, aged 18-70 years were alternately allocated to: intramuscular acupuncture (n=59); periosteal acupuncture (n=55); or control group with information only (n=30). All patients were encouraged to stay active. Acupuncture was administered with eight treatments during five weeks, and two optional additional treatments after one month. Pain was estimated with a daily VAS in a pain diary and with an average weekly pain score. Clinically relevant pain relief was defined as at least a 30% decrease from the initial value. Physical functioning was evaluated with Disability Rating Index. All estimations were performed prior to treatment, one week after, and one, three and six months after treatment.

Results There were no differences between the effects of the two acupuncture methods. There were differences between each of the two acupuncture groups compared with the control group on all test occasions up to one month after treatment with respect to the pain diary and one week after treatment with respect to pain last week (P<0.05). Pain relief as measured by a pain diary was obtained in 29 patients in the intramuscular acupuncture group, 25 in the periosteal acupuncture group, and 5 patients in the control group. Six months after treatment, 46% of the intramuscular acupuncture patients and 45% of the periosteal acupuncture patients had obtained pain relief in terms of the pain diary. The corresponding figure for pain last week was 29% in each group.

Conclusion Periosteal pecking was no more effective than standard intramuscular acupuncture, but both were more effective than information only.

Keywords

Acupuncture, clinically relevant pain relief, chronic musculoskeletal pain.

Introduction

Pain in the neck and low back is a common problem in industrialised countries. In Sweden the prevalence among adults varies between 21–43% depending on the type of question asked. These patients often seek physiotherapy, where the aim is to relieve pain and improve physical functioning. Treatment options are numerous although evidence for more active treatment strategies is growing. Acupuncture has gained popularity in physiotherapy and the intramuscular technique with elicitation of de qi is relatively well documented today for patients with chronic pain in the neck and low back. However, the effect on physical functioning is modest and short lived. The mechanisms behind the pain relieving effect are partly explained by alterations in the central nervous system and by peripheral mechanisms.
Periosteal acupuncture has shown promising results in the clinic. In an experimental study in healthy volunteers, electrical stimulation of the periosteum was superior to stimulation of musculature and skin in alleviating pain originating from periosteum and musculature. The efficacy of periosteal stimulation in a clinical setting was tested by Weinet et al who showed a superiority of periosteal electrical stimulation to placebo stimulation with respect to pain relief but not to other physical functioning in patients with osteoarthritis of the knee. As we could not find any reports of comparisons between intramuscular and periosteal acupuncture in patients with chronic pain in the neck and low back, we undertook a study with the hypothesis that periosteal stimulation is superior to intramuscular stimulation for pain relief, physical functioning and psychological variables, the mechanisms for this being the same as for other forms of acupuncture stimulation. An acceptance of this hypothesis would increase treatment efficiency. Our first, recently published report of other outcomes from the same study showed no differences between the two techniques with respect to psychological variables.

The present aim was to compare three patient groups, one with intramuscular acupuncture, one with periosteal acupuncture and a third information control group, with respect to clinically relevant pain relief, physical functioning and consumption of analgesics in patients suffering from chronic musculoskeletal pain in the neck or low back or both.

**Material and Methods**

**Patients**

All patients seeking primary care for musculoskeletal neck or low back pain or both referred for physiotherapy between 1996 and 2000 in Krokom, a sparsely populated municipality in northern Sweden, formed the study population. The criteria for inclusion were: age 18–70 years, and pain originating from the neck or low back for over three months, that could be provoked by active or passive movement ie rotation, and/or extension. Criteria for exclusion were: other serious medical conditions; a coagulation disorder; treatment with anticoagulants or antidepressants; fibromyalgia; pregnancy; symptoms of neurogenic pain, eg signs of disturbances of sensation and signs of neurological deficits within the area of pain; diagnosis of substance addiction; treatment with acupuncture within three months prior to enrolment; and/or inability to speak and read Swedish.

The patients were divided into three groups according to neck pain, low-back pain or both. The patients in each group were allocated alternately to intramuscular acupuncture (IMA) and periosteal acupuncture (PA). We originally calculated that 50 patients in each group would be sufficient to detect a clinically meaningful difference in pain scores between groups, using parametric statistics. After the first 41 patients had been allocated in this way a control group (CG) was added as the research team was revised and the new team considered this a way of strengthening the quality of the study. No results were available at that stage; no new power calculation was conducted. For the subsequent three years, every third presenting patient regardless of location of pain was assigned to the control group. When the treatment groups had reached a sufficient number, an additional 14 consecutive patients were included as controls to make this group sufficiently large as well. The patients were neither charged for acupuncture nor did they receive compensation for participating in the trial.

**Treatment**

At each measurement time point, all patients were encouraged by the treating physiotherapist to be active and to maintain and increase mobility, particularly in the painful parts of the body. This encouragement was given as routine to all patients who were treated for these problems during that period in that primary care unit.

**Intramuscular acupuncture (IMA)**

Standard Western style intramuscular acupuncture was used in traditional acupuncture points within the painful area (Table 1). When the practitioner felt the characteristic resistance at a depth of insertion of usually 1–3cm, the needle was twirled until the patient felt the characteristic needle sensation ie numbness, soreness or slight pain. De qi was elicited two additional times during each session. The number of needles inserted was successively increased from 4 to 12 in accordance with the patient’s response to the treatment (Fig 1A).
Table 1 Description of acupuncture according to STRICTA guidelines

1 Acupuncture rationale
In both groups Western style acupuncture with individualised point localisation according to pain distribution.

2 Needling details
Points used
- IMA - acupuncture points within painful area
- PA - acupuncture points in tender areas within pain distribution (Fig 1); bilateral

Number of needles
- IMA - 4–12
- PA - 2–8

Depths of insertion
- IMA - to characteristic resistance felt by practitioner
- PA - to periosteum

Responses elicited
- IMA - de qi
- PA - radiating sensation

Needle stimulation
- IMA - manual rotation
- PA - periosteal tapping

Needle retention time
30 minutes

Needle type
Chinese stainless steel disposable needles 0.3x30-50mm (neck), 0.4x50–75mm (back)

3 Treatment regimen
Treatment sessions
8

Frequency of treatment
2 per week for 3 weeks, then 1 per week for 2 weeks. After 1 month, 2 optional treatments of same kind

4 Co-interventions
Advice

5 Practitioner
Expert in orthopaedic manual therapies; University courses in acupuncture; >2000 treatments of each type performed before start of study

6 Control intervention
Individual advice to control group
Blinding of participants with respect to acupuncture.

IMA - intramuscular acupuncture; PA - periosteal acupuncture

Periosteal acupuncture (PA)
The needles were inserted in tender areas, not always standard acupuncture points, at sites on the underlying periosteum, and then used to prick a small periosteal area (5–10mm in diameter), 2–4 times per second, for approximately 10 seconds (Table 1). All patients felt a radiating sensation, and the needles remained inserted just away from the periosteum for another 30 minutes, without further stimulation. The number of needles employed was increased successively from two to eight (Fig 1B).12

The combination of acupuncture points was chosen individually on the basis of pain location. Thus, points on the neck and lower back were used as local points and certain acupuncture points on the upper and lower limbs, respectively, were employed as distal points.12

All treatments were carried out by the same physiotherapist (YH), who specialises in acupuncture and had performed more than 2000 treatments of each type prior to the study (Table 1).12

Both types of acupuncture were administered twice during each of the first three weeks and once during each of the following two weeks for 30 minutes per session. One month after the series of treatments was completed and evaluated, the patients were offered a maximum of two follow up treatments of the same kind one week apart.

The study was single blind with respect to type of acupuncture stimulation.

Control group (CG)
Apart from the routine encouragement to be active and mobile at all measurement points, these patients also received information from the evaluating physiotherapist. They were promised acupuncture following the three month control period.

Outcome methods
Current pain by pain diary (PD)
This was estimated by the patient in a pain diary employing a standard visual analogue scale (VAS) with the anchor points ‘no pain’ and ‘worst imaginable pain’.13 It was completed three times a day for seven days. From the maximal values for each day, the median VAS value for the entire week was calculated.
The pain diary, often used in pain clinics and in scientific studies, was chosen because pain ratings consisting of numerous ratings have shown good reliability and the sample was relatively small. On the initial evaluation the patients were categorised according to severity of pain for each of the two pain variables, with low pain indicated by less than 30mm, medium pain between 30 and 60mm and high pain more than 60mm on the VAS, respectively. We defined clinically relevant pain relief as follows: for those with low pain, a reduction of 10mm or more on the VAS; for those with medium pain, a reduction of 20mm or more; and for those with high pain, a reduction of more than 30mm. Farrar et al showed in large samples of patients with chronic pain that a 30% reduction of pain measured in a linear scale, or a two step decrease when evaluated on an 11 step numerical rating scale, could be regarded as clinically relevant. Thus, we used non-parametric statistics: the chi square and sign tests for analyses of pain and intake of analgesics, and the Mann-Whitney test, the Kruskal-Wallis test and Friedman's ANOVA by ranks for analyses of physical functioning. For analyses the SPSS 12.0 (Statistical package for Social Science) and the SAS system were used. The level of significance was set to P<0.05 for between group comparisons and to P<0.01 for within group comparisons. Our definition of clinically relevant pain relief was not validated. Analyses with parametric statistics were also undertaken as a basis for statistical discussions.

Ethical considerations
The study was approved by the Ethics Committees of the Universities of Gothenburg and Umeå, as well as by the Karolinska Institutet in Stockholm. All patients gave their verbal and written consent and were free to withdraw without stating any reason.

Results
Patients
A total of 154 patients who fulfilled the criteria and agreed to participate in the study were allocated to intramuscular (n=59), periosteal (n=55) or control (n=30) groups. Ten patients (6.5%), equally distributed between the groups, did not complete the first evaluation and were therefore excluded. Thus, 144 patients were included in the analyses. At three months there were no dropouts in either group. The dropout rates at the time of the six month evaluation were 12% and 7% for the IMA and the PA groups,
respectively. Reasons for dropout were other medical condition or injury, not related to acupuncture. Demographic data are presented in Table 2.12

**Between group comparisons**

There were no differences between the effects on the two treatment groups in any of the outcome variables at any assessment period (Tables 3, 4).

When each treatment group was compared with the control group (CG) before treatment, no differences were found regarding pain (Table 3) or intake of analgesics (Table 5), whereas both treatment groups registered higher scores than the CG in capacity for demanding activities (data not shown).

When each treatment group was compared with the CG after treatment, a higher proportion of patients in both treatment groups had obtained clinically relevant pain relief with respect to the median current pain by diary (PD) and to pain last week (PLW), for PD on all test occasions up till one month after treatment and for PLW one week after treatment (P<0.05 for all comparisons) (Table 4).

No differences were found with respect to intake of analgesics and capacity for physical functioning between either treatment group and CG (Table 5).

**Within group comparisons**

Six months after end of treatment, 46% of the IMA patients and 45% of the PA patients had obtained clinically relevant pain relief in terms of PD. The corresponding figure for PLW was 29% of the patients in each group (Table 5).

**Intake of analgesics**

Significant decreases of intake were seen at one month after treatment in IMA patients and in PA patients at all tests except the six month test. There were no differences in intake in the CG (Table 5). No strong opioids were used.

**Capacity for physical functioning**

The patients in the IMA group increased their reported capacity in both demanding activities and work related activities, up to six months after...
### Table 4 Total numbers of patients scoring pain diary and pain last week, and responders at various time points

<table>
<thead>
<tr>
<th></th>
<th>Middle of treatment</th>
<th>1 week</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
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</thead>
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<td>Pain diary</td>
<td>57</td>
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<td>29</td>
<td>29</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>% responders</td>
<td>47%</td>
<td>51%</td>
<td>51%</td>
<td>50%</td>
<td>46%</td>
</tr>
<tr>
<td>Pain last week</td>
<td>*</td>
<td>59</td>
<td>59</td>
<td>55</td>
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<tr>
<td>Responders</td>
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<td>42%</td>
<td>38%</td>
<td>29%</td>
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<td></td>
<td></td>
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<tr>
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<tr>
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<td>*</td>
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<td>55</td>
<td>52</td>
<td>51</td>
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<tr>
<td>Responders</td>
<td>*</td>
<td>28</td>
<td>24</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>% responders</td>
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<td>28</td>
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<tr>
<td>Responders</td>
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<td>6</td>
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<tr>
<td>% responders</td>
<td>11%</td>
<td>21%</td>
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</tbody>
</table>

Values are numbers or %; see text for definition of responders.

* not assessed

### Table 5 Numbers of patients using no analgesics, and numbers engaged in work related activities, and median Disability Rating Index (DRI) score

<table>
<thead>
<tr>
<th></th>
<th>Before treatment</th>
<th>Middle of treatment</th>
<th>1 week</th>
<th>1 month after termination of treatment</th>
<th>3 months</th>
<th>6 months</th>
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<td><strong>Intramuscular acupuncture group</strong></td>
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<td></td>
</tr>
<tr>
<td>No analgesics</td>
<td>19/53</td>
<td>23/55</td>
<td>27/56</td>
<td>P&lt;0.05</td>
<td>*P&lt;0.01</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Working (n=)</td>
<td>59</td>
<td>58</td>
<td>49.2</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
</tr>
<tr>
<td>Median DRI</td>
<td>64</td>
<td>ns</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>No analgesics</td>
<td>21/55</td>
<td>30/52</td>
<td>35/53</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
</tr>
<tr>
<td>Working (n=)</td>
<td>53</td>
<td>54</td>
<td>42</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
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</tr>
<tr>
<td>Median DRI</td>
<td>57.5</td>
<td>ns</td>
<td>*P&lt;0.01</td>
<td>*P&lt;0.01</td>
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<tr>
<td><strong>Control group</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No analgesics</td>
<td>13/29</td>
<td>15/29</td>
<td>16/28</td>
<td>ns</td>
<td>ns</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Working (n=)</td>
<td>28</td>
<td>30</td>
<td>50.2</td>
<td>ns</td>
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</tr>
<tr>
<td>Median DRI</td>
<td>46</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
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</tr>
</tbody>
</table>

P values are within group changes; * significant according to predefined level.
treatment. The PA patients increased their capacity in demanding activities up to three months and in work related activities up to one month after treatment. There were no differences in physical functioning in the CG patients (Table 5). No correlations were observed between the level of initial pain and response to acupuncture (data not shown). Comparisons between analyses performed with parametric statistics and different forms of non-parametric statistics showed no differences (data not shown).

Discussion
This is the first time that the effect of periosteal acupuncture on pain, intake of analgesics and physical functioning have been tested in patients with chronic musculoskeletal pain in the neck and low back. Our hypothesis that deeper or periosteal stimulation is superior to the more frequently used intramuscular stimulation was not confirmed in this study. An explanation may be the similarity in acupuncture dosage. The patients in the IMA group had more needles in traditional acupuncture points and were stimulated three times; the PA group had fewer needles and were stimulated only once in the periosteum. Considering the clinical hypothesis that periosteal stimulation is much stronger, the difference in stimulation was rather small. Another reason may be the clinical fact that patients react differently to acupuncture stimulation, and that the optimal dosage thus varies between individual patients. This causes a problem in all studies where patients are consecutively recruited and randomised to treatment groups with different stimulation techniques and with the same amount of stimulation to all patients.

Our finding that there were differences between each acupuncture group and the control group in ratings of pain, but not in physical functioning or in intake of analgesics, is also consistent with those of other studies of acupuncture as a single intervention for patients with chronic low back pain or chronic osteoarthritis of the knee. Accordinly, acupuncture, regardless of method, combined with encouragement to stay active and mobile, is superior to the same encouragement plus information, together with a promise of later treatment, in yielding clinically relevant pain relief. To increase physical functioning, a more extensive exercise programme is probably necessary.

Forty five percent of the patients receiving acupuncture had clinically relevant pain relief recorded in pain diaries up to six months after the end of treatment regardless of acupuncture method. These findings are consistent with findings in randomised studies on relevant patient groups where pain relief remained up to three and even six months after end of treatment. The decrease in pain last week (PLW) in the PA group one month after treatment corresponded well with the changes in anxiety in our study of the same patients previously reported. An estimation of average pain during the preceding week is probably more influenced by emotional factors than are estimations of current pain three times a day in a diary. These findings may indicate that each method of estimating pain evaluates different aspects of pain, with both yielding valuable information.

We regarded advice and information as a relevant control intervention, as it is the usual first care for a majority of patients with neck or back pain in Swedish primary care. Alone, however, it is not regarded as an evidence based treatment of chronic pain.

Since we had limited access to acupuncture naïve patients, we chose to accept the disadvantages of not controlling for nonspecific effects, i.e. we did not use a placebo control. Randomising patients instead of alternately allocating the patients to the intervention groups would have strengthened the results. We consider this study as one of acupuncture dosage, i.e. a phase II study.

The absence of a scale of global improvement was counteracted by categorisation of the pain levels and by increased demands on pain relief in relation to the initial pain level.

The lack of validation of our way of defining pain relief as clinically relevant is partly compensated for by the fact that calculations with parametric statistics and different forms of non-parametric statistics gave similar results.

Conclusions
No differences were found between periosteal and intramuscular acupuncture in patients with chronic musculoskeletal pain in the neck or low back. One month after end of treatment, a higher proportion of patients in both acupuncture groups had clinically relevant pain relief than the proportion in an
information control group. Six months after treatment, 45% of the patients in the acupuncture groups had obtained clinically relevant pain relief.

Acknowledgements
This study was supported by grants from Jämtland County Council and Crown Princess Margareta’s Working Group for the Visibly Disabled.

Conflict of interest
No conflict of interest has been declared by the authors.

Summary points
Periostal acupuncture is used as an alternative to intramuscular needling, but there is little evidence on which is more effective.

This controlled trial found no difference between these forms of acupuncture for pain relief in patients with neck or low back pain.

Both treatments were superior to information only.

Reference list