TENS, Electroacupuncture and Ice Massage: Comparison of Treatment for Osteoarthritis of the Knee

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The Chondrocyte and Osteoarthritis (OA)

- mechanical overloading
- age
- genetic predisposition

Cartilage matrix synthesis and degradation lead to Osteoarthritis.

Scientific basics and general skills II; Angerer / Kraitsy; 090112
Osteoarthritis (OA)

- chronic, non-inflammatory joint disease, characterized by loss of articular cartilage and thickening of subchondral bone
- painful and disabling disease
- most common joint disease, 80% of elderly population affected, Austria 2009: 80,000 days of hospital care and 12,200 surgical joint replacements (knee only)
- Joint replacement therapy is the only curative therapy
- Pathogenesis unknown (IL-1, NO and degradative enzymes)
Treatment

Treatment goal is pain relief!

Routine management: analgetics and anti-inflammatory drugs → side effects

Non-invasive treatments: (PICO)

1.) Transcutaneous electrical nerve stimulation (TENS)
2.) Electroacupuncture (EA)
3.) Ice massage
Aim and Hypothesis

No comparative trials concerning the three modalities

**AIM:** Effects of the electrical modalities (TENS and EA) and ice massage in the treatment of knee pain due to OA.

**Hypothesis:** Electrical modalities and ice massage would be statistically superior to placebo.
Methods

• randomized
• parallel
• single - blinded study (assessor)
Participants 1 (PICO)

100 outpatients (91 female, 9 male)
divided into 4 groups (Gr1 – Gr4); 25 patients/group

Inclusion:

- duration of knee pain of 6 months or more
- osteoarthritic radiological findings
- no gross leg malalignment
- no mechanical block to knee motion
- no significant concomitant medical problem or bleeding tendency
- not undergoing any specific medical or surgical treatment or physical therapy
- no cardiac pacemaker
Participants 2

Gender:

Group 1: 0M/25F
Group 2: 3M/22F
Group 3: 2M/23F
Group 4: 4M/21F
Participants 3

Symptom duration:

a) = 0 – 9 years
b) = 10 – 19 years
c) = 20 – 40 years

Mean age (range): 58.1 (45-70) years old

Gr 1: a)7, b)11, c)7
Gr 2: a)15, b)8, c)2
Gr 3: a)11, b)11, c)3
Gr 4: a)9, b)10, c)6

Gr 1: (45-69) years old
Gr 2: (45-69) years old
Gr 3: (45-70) years old
Gr 4: (45-69) years old
Interventions (PIÇO)

Gr 1:

Ice massage: ice cubes at knee (4 acupuncture points according to chinese literature)
5 minutes each point for total of 20 minutes, 5 days per week for 2 weeks

Gr 2:

Control: placebo TENS applied on same 4 points for total of 20 minutes, 5 days per week for 2 weeks
Interventions

Gr 3:
Acupuncture-like TENS: 4 small rubber electrode, 0.4-2.5 volt intermittent rectangular waveform at 4Hz and 1000 microsec., current increased slowly to create muscle contraction, just below pain threshold, 20 minutes, 5 days per week for 2 weeks

Gr 4:
Electropuncture: stainless steel acupuncture needles inserted to 0.5-1.0 inch depth at the same 4 acupoints, needles connected to electrostimulator and treatment with same parameters as acupuncture-like TENS
Outcomes \((\text{PICO})\)

1 - Present pain intensity (PPI) \((1-5 \text{ scale})\)
   (mild: 1, moderate: 2, severe: 3, very severe: 4, excruciating: 5)

2 – Stiffness

3 – 50 foot walking time (min.)

4 – Strength - Isometric quadriceps (kg)

5 – ISOM - Knee flexion (degrees)
Evaluation of parameters 1

Table 2: The Evaluation of the parameters

<table>
<thead>
<tr>
<th></th>
<th>Pain</th>
<th>Stiffness</th>
<th>50 foot walking time</th>
<th>Quantriceps muscle strength</th>
<th>Knee flexion</th>
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</thead>
<tbody>
<tr>
<td>TENS (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pretreatment</td>
<td>12.1 + 1.1</td>
<td>13.7 + 7.3</td>
<td>47.3 + 49.4</td>
<td>8.0 + 4.7</td>
<td>127.8 + 8.9</td>
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<tr>
<td>Posttreatment</td>
<td>0.2 + 0.5 **</td>
<td>2.2 + 5.2 **</td>
<td>19.1 + 16.7 *</td>
<td>13.0 + 4.4 **</td>
<td>139 + 7.6 **</td>
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<td>EA (n=20)</td>
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<tr>
<td>Pretreatment</td>
<td>1.36 + 0.5</td>
<td>2.0 + 4.3</td>
<td>21.9 + 4.1</td>
<td>8.5 + 1.6</td>
<td>127.6 + 7.6</td>
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<tr>
<td>Posttreatment</td>
<td>0 **</td>
<td>0.8 + 1.8 **</td>
<td>13.4 + 4.2 **</td>
<td>12.1 + 2.2 **</td>
<td>130.3 + 6.5 **</td>
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<td>Ice massage (n=25)</td>
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<tr>
<td>Pretreatment</td>
<td>0.7 + 0.5</td>
<td>7.2 + 5.4</td>
<td>28.4 + 6.7</td>
<td>7.3 + 2.4</td>
<td>127.2 + 7.6</td>
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<tr>
<td>Posttreatment</td>
<td>0.4 + 0.4 *</td>
<td>4.3 + 4.9 *</td>
<td>19.4 + 2.8 **</td>
<td>9.3 + 2.8 **</td>
<td>128.4 + 6.9 NS</td>
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<td>Plasma (n=25)</td>
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<td>7.8 + 4.2</td>
<td>34.7 + 3.8</td>
<td>7.8 + 1.4</td>
<td>128.1 + 7.2</td>
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<tr>
<td>Posttreatment</td>
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<td>7.2 + 4.1 NS</td>
<td>26.1 + 3.7 NS</td>
<td>7.0 + 1.7 NS</td>
<td>119.2 + 5.3 NS</td>
</tr>
</tbody>
</table>

* P < 0.05, ** P < 0.001; NS: Not significant

Evaluation of pain, stiffness, 50 foot walking time and knee flexion degree:
All treatments more effective than placebo!
There were no significant differences between the three treatment results (Table 3). Comparison of the treatment results of these modalities revealed statistically significant differences among them (Table 3).
Evaluation of parameters 2

„The improvement as assessed by PPI changes clearly shows that EA was the most effective modality for pain reduction – the main symptom of OA of the knee.“

Acupuncture with low-frequency high-intensity electrical stimulation generally involve the Endorphinergic mechanism, generate a slow-onset analgesia, have long-lasting results and a cumulative effect.
Conclusion

To explore the differences between EA, TENS and ice massage:

• Larger
• prospective
• randomized
• and long-term studies

are needed.