



Peripheral Electrical Stimulation in Capsaicin Induced Secondary Hyperalgesia: A psychophysical evaluation.

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Background and rationale

Peripheral Electrical Stimulation techniques are used in the treatment of acute and persistent pain conditions (1,2) but their underlying mechanisms are not well understood. We investigated the effects of a novel peripheral electrical stimulation device (PENS: Algotec UK) on capsaicin-induced pain and hyperalgesia in healthy volunteers.

Device (Figure 1)

- Voltage dependant
- Alternating frequency
- 100Hz / 2 Hz
- Pulse width 2 ms
- Stimulation via subcutaneous un-insulated probe (~8cm length)



Figure 1

Methods

The experimental design is shown in Figure 2. Sixteen healthy volunteers were recruited in this randomized crossover study. Subjects completed questionnaires relating to their personality trait and emotional state (STAI, mood scale), attitudes to pain (PCS) and to the procedure (credibility scale). Mechanical hyperalgesia was induced by topical 1% capsaicin applied to the medial aspect of the leg for 30 minutes. Areas of Dynamic Mechanical Allodynia (DMA) and Punctate Hyperalgesia (PH) were mapped along 8 radiating axes. The stimulator electrode was inserted remote to the hyperalgesic area and advanced subcutaneously under both the primary and secondary areas of mechanical hyperalgesia. Subjects received non-painful electrical stimulation for 25 minutes, adjusted so it was Perceived (PS), Non-Perceived (NS) or Sham (SS) in three separate sessions that were balanced for order. Subjective ongoing and provoked pain scores, areas of DMA and PH were recorded before and after electric stimulation.



Figure 2 Experimental design.

1. Psychological questionnaires
2. 1% topical Capsaicin cream for 30 mins
3. Dynamic mechanical allodynia and punctate hyperalgesia (512mN) mapping
4. Electrical stimulation, in random sequence across sessions [Perceived Stimulation (PS), Non-perceived stimulation (NS), Sham stimulation (SS)] The 3 sessions were balanced for order.
5. Dynamic mechanical allodynia and punctate hyperalgesia mapping

Results

There was no significant difference in subject scores for questionnaires, (STAI, mood scale) across all sessions. Attitudes to pain (PCS) and to the procedure (credibility scale) were stable.

Ongoing pain and unpleasantness of ongoing pain ratings were significantly lower after Perceived Stimulation (PS) when compared with Non-perceived stimulation (NS) and Sham Stimulation (SS). [Fig 3(a) and 3(c)]

Provoked pain and unpleasantness of provoked pain ratings were decreased more after PS than NS and ratings increased after SS. This trend did not reach statistical significance. [Fig 3(b) and Fig 3(d)]

There was no difference in the post stimulation areas mapped for Dynamic Mechanical Allodynia (DMA). [Fig.3(e)]

The areas of Punctate Hyperalgesia (PH) were decreased after PS and increased after NS and to a greater extent after SS suggesting that there is an anti-hyperalgesic effect after PS. This effect did not reach statistical significance. [Fig 3 (f)]

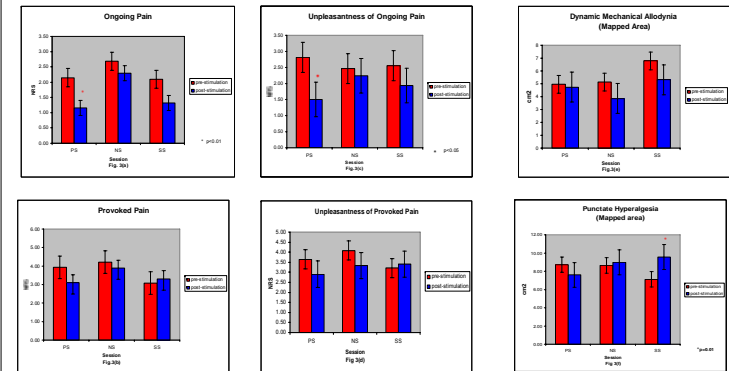


Figure 3

PS Perceived Stimulation
NS Non-perceived Stimulation
SS Sham Stimulation

Conclusion and significance

Our current results suggest that peripheral subcutaneous electrical stimulation has an analgesic effect when compared to sham stimulation. Electrical stimulation that was perceived (compared to when it was not perceived) tended to reduce capsaicin induced ongoing pain. Further analyses are underway that examine how analgesic effect afforded by peripheral electrical stimulation related to subjective mood, pain-relevant personality traits and personal beliefs about the effectiveness of the stimulation. We are conducting a further study using functional MRI to investigate the neural correlates of these processes.

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References

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