Is pain downregulated if you expect a painful stimulus immediately nearby?

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There are many things that can alter our perception of a noxious stimulus, such as spatial attention\(^1\) or distraction.\(^2\) However, emerging evidence suggests that descending mechanisms may modulate pain in a more precise and somatotopically-determined manner. Thus we aimed to determine whether pain is downregulated when there is a high probability of noxious stimulation on one side or the other of the stimulation site.

We used radiant heat stimulation (Nd:YAP laser) applied to 3 zones of the skin (one of which was unknown) in a localisation (L) and non-localisation (NL) condition to investigate this issue. We predicted that during L, but not NL, pain evoked by stimulations of the unknown zone (middle zone) would be lower than pain evoked by stimulation of the expected zones (distal and proximal zones). This would be evidenced by a significant condition x zone interaction and significant post-hoc tests for pain scores of the middle zone only (decreased in L condition).

**RESULTS**

Our hypothesis was not supported - there was no difference in pain scores of the middle zone between conditions. However, based on the significant condition x zone interaction, the results imply descending modulation of the nociceptive system. This site-specific effect may reflect descending inhibitory control based on whether or not the stimulus was presented in the proximal zone (ie, participants downregulated information from one target zone only).

**METHODS**

**Participants**
- 18 right-handed healthy participants (mean age: 27.2 ± 5.5 yrs; 12 female)

**Noxious stimulation**
- Nd:YAP, 1034 μm laser applied to the dorsal aspect of each participant’s right arm
- Pin prick threshold was determined and one stimulus energy (resulting in 20-80 NRS rating) was used for testing.

**Testing set-up**

**Outcomes**
- Pain ratings: 0-100 numerical rating scale (0=no pain, 100 = worst pinprick pain imaginable) taken after each laser stimulus
- Skin temperature: Infrared thermography of the right arm (FLIR SC620; FLIR systems) was measured pre- and post-laser stimulation.

**CONDITIONS**

Two conditions were applied in random order to each participant (45 mins between each condition). Condition order was counterbalanced amongst participants. Stimuli were applied in a random order to the Proximal (20), Middle (10), and Distal (20) zones in both conditions (matched stimuli order between conditions in each participant).

1) **Localisation (L)**

Participant instructions: We will apply stimuli to one of two zones on your arm (distal or proximal). Please tell us in which zone you felt the stimulus and then rate how painful it was.

2) **Non-localisation (NL)**

Participant instructions: Please rate the level of pain you experienced after each stimulus.

**STATS**

- A 2 (L, NL) x 3 (Proximal, Middle, Distal) repeated measures ANOVA was used to evaluate pain scores. Paired t-tests were used to compare pain scores between conditions for each zone.
- Temperature data were analysed using difference scores (pre-post) using a 2 (L, NL) x 3 (Proximal, Middle, Distal) RM ANOVA.

**Pain rating (0-100mm NRS)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Proximal Zone</th>
<th>Middle Zone</th>
<th>Distal Zone</th>
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</thead>
<tbody>
<tr>
<td>L</td>
<td>30</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>NL</td>
<td>35</td>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>

Condition x zone interaction: p=0.02

- Main effect of zone (p<0.01), no effect of condition (p=0.09) and no zone x condition interaction (p=0.57).
- Overall, distal zone was cooler following laser stimuli (-0.03 deg) than middle zone (0.22 deg, p<0.01) but no different than the proximal zone (0.20 deg, p=0.09).

**Refs:**