Supraspinal Modulation of Trigeminal Nociception and Pain: Emotional Controls (EON) and Diffuse Noxious Inhibitory Controls (DNIC)

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Introduction

Trigeminal nerve stimulation elicited by a custom concentric electrode has been shown to elicit eyelink reflexes that are abolished by local anesthetics, suggesting nociceptive specificity (i.e., nociceptive blink reflex). The purpose of this study was to examine the modulation of trigeminal nociception (assessed via the nociceptive blink reflex) and pain (assessed via self-report) by two forms of supraspinal influences: emotional controls (EON) and diffuse noxious inhibitory controls (DNIC). EON were engaged by the presentation of standardized emotionally-charged picture stimuli (pleasant, neutral, and unpleasant) that have been shown to reliably evoke pleasure-induced inhibition and displeasure-induced facilitation of pain and spinal nociception. DNIC were engaged by the application of heterotopic forearm ischemia.

Objective

To examine supraspinal modulation of trigeminal nociception and pain by EON and DNIC

Participants

36 Healthy Students

Characteristics: 12 Men, 24 Women; White non-Hispanic (78%), single (94%), and employed (67%); average age ± 21.22 (SD ± 2.27)

1 dropped out, 1 excluded for equipment failure (final n=34)

Exclusion Criteria:

• ≤ 18 years of age
• Current acute illness
• Cardiovascular, neurological, and/or circulatory problems
• Recent use of anxiolytic, antidepressant, antihistaminic, or antihypeensive medication
• Recent head trauma
• Specific photos of snakes or spiders
• Chronic pain condition (including headache disorders)
• Reynaud’s disease

Measurement of Trigeminal Pain/Nociception

• NBR Magnitude: mean of orbicularis oculi EMG in 27-87 ms post-stimulus interval
• Nociceptive specific - abolished by local anesthetic

Emotional Controls (ECON): Picture-Viewing

The International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 1999)

Picture Content

• 24 pictures presented in pseudorandom order of pictures per content
• Pictures presented 4x, 12-22 s ITI
• Nociceptive specific - abolished by local anesthetic

Procedure

• Ischemia Task

- Stimulation conducted for 2 min, rate/1,8
- Arm desensitized for 5 min by noxious skin stimuli (220 mmHg for 2 min) to induce ischemia

• Nociceptive Task

- Pain ratings
- Nociceptive reflexes 1 min after ischemia

- Pain ratings and nociceptive blocks assessed following each stimulus.

Results: DNIC

<table>
<thead>
<tr>
<th>Pain Ratings</th>
<th>Main effect of DNIC Phase was significant (F(2,66)=7.47, p&lt;.01)</th>
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<tbody>
<tr>
<td></td>
<td>NBR: Main effect of DNIC Phase was significant (F(2,66)=7.47, p&lt;.01)</td>
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Results: ECON

<table>
<thead>
<tr>
<th>Pain Ratings</th>
<th>Main effect of Picture Content was significant (F(2,66)=7.80, p&lt;0.01, η²=0.19)</th>
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<td>Compared to neutral, there was greater pain during attack pictures (p&lt;0.01, η²=0.19) and less pain during erotic pictures (p&lt;0.01, η²=0.15)</td>
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Conclusions

• Emotional controls (ECON) and diffuse noxious inhibitory controls (DNIC) modulated trigeminal nociception (nociceptive blink) and pain modulation (nociceptive blink reflex)
• DNIC and ECON are believed to be mediated by different supraspinal circuits (subnucleus reticularis dorsalis vs. periaqueductal gray and rostral ventromedial medulla, respectively); the lack of covariance between ECON and DNIC is consistent with this idea
• These procedures can be used to study supraspinal modulation of nociceptive processing in disorders of the trigeminal pain system, including headache and craniofacial pain

Note

- Recent use of analgesic, antidepressant, anxiolytic, or antihypertensive medication
- Specific phobia of snakes or spiders
- Chronic pain condition (including headache disorders)

Results: Correlation Between ECON & DNIC