

## AGE INTERACTS WITH FREQUENCY IN THE TEMPORAL SUMMATION OF PAINFUL ELECTRICAL STIMULI.

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**Background and Aims:** There is growing interest in the impact of ageing on the plasticity of pain responses. Clinical pain is often associated with increased responses to noxious stimuli, and there is evidence that older people experience prolonged hyperalgesia under experimental conditions (1). Further insights into the association of ageing and pain plasticity may be afforded through the assessment of temporal summation of pain. Of particular interest is the lower boundary of stimulus frequency required to elicit temporal summation in older people. The objective of this study was to evaluate the influence of age and stimulus frequency on temporal summation of responses to repeated, painful electrical stimuli in humans.

**Methods:** A group of young ( $n = 15$ , mean age = 25 years) and old subjects ( $n = 15$ , mean age = 70 years) were stimulated over the sural nerve with electrical stimuli (5 x 1ms pulses over 13 ms at 330 Hz). Double random staircases were used to measure pain thresholds and nociceptive RIII thresholds. Pain intensity ratings (0 to 100) and A $\delta$  mediated RIII amplitudes were recorded during single stimuli and trains of five stimuli at intensities 110% of RIII threshold. Stimulus trains were delivered at frequencies of 0.2, 0.25, 0.33, 1 and 2 Hz on five occasions each in random order. Pain ratings and RIII reflexes were measured for the final stimulus in each train. RIII reflexes were quantified with root mean square (RMS) calculations for 70-130 ms post stimulus period. The effects of age-group and stimulus frequency on pain ratings and RIII reflexes were assessed with repeated measures ANOVA.

**Results:** A significant interaction between the effects of age and stimulus frequency on pain intensity ratings was due to temporal summation of stimuli at slow frequencies in the older group, whereas the young subjects showed no temporal summation when stimuli were delivered at a rate slower than once every 3 sec ( $F(5,24) = 3.9$ ,  $p > 0.01$ )(single pulse young =  $58.1 \pm 3.3$  old =  $53.8 \pm 3.1$ , 0.2Hz young =  $58.8 \pm 3.5$  old =  $60.3 \pm 3.3$ , 0.25Hz young =  $58.9 \pm 3.7$  old =  $63.3 \pm 3.7$ ). The RMS of the RIII reflex increased with increasing frequency of repeated stimuli ( $F(5,24) = 5.6$ ,  $p > 0.001$ )(single pulse  $4.3 \pm 3.1$ , 0.2Hz  $3.2 \pm 2.6$ , 0.25Hz  $3.2 \pm 2.3$ , 0.33Hz  $3.4 \pm 2.5$ , 1Hz  $5.7 \pm 4.5$ , 3Hz  $8.0 \pm 10.2$ ) but did not differ between the age groups, nor was there any interaction between age and stimulus frequency.

**Conclusions:** The temporal summation of pain intensity ratings occurs at slower stimulation frequencies in older people, but this is not true for the summation of A $\delta$  fibre mediated withdrawal reflexes. These findings emphasise the primary role of C fibre inputs in temporal summation processes and may also suggest some important age-related change in the plasticity of central nervous system mechanisms.

(1) Zheng Z, et al. 2000 Pain 85: 51-8