Pain-related evoked potentials are differentially affected by chronic pain and aging

A. Dorado[1], C. Sitges[1], J.L. Terrasa [1], M. Van der Meulen[2], F. Anton[2], A.M. González-Roldán[1].

[1]Research Institute of Health Sciences (IUNICS), Health Research Institute of the Balearic Islands (IdISBa), University of the Balearic Islands, Palma, Spain

[2]Institute of Health and Behaviour, Department of Behavioural and Cognitive Sciences, University of Luxembourg, Esch-sur-Alzette, Luxembourg

IV International Congress of Psychobiology
IV Congreso Internacional de Psicobiología

Introduction

The prevalence of chronic pain is known to increase with advancing age (Patel et al., 2013). Moreover, aging seems to be associated with altered pain perception (increased pain thresholds, but reduced amplitudes in pain-related evoked potentials) (Lautenbacher et al., 2017). However, few studies have investigated how aging and chronic pain combine to modulate pain perception. The present study compared pain event-related potentials (ERPs) of older participants (>60 years old) with and without chronic musculoskeletal pain, as well as pain-free younger adults (<25 years old).

The objective was to examine the cerebral processing of painful stimulation in older adults with chronic pain, to better understand how chronic pain and aging combine.

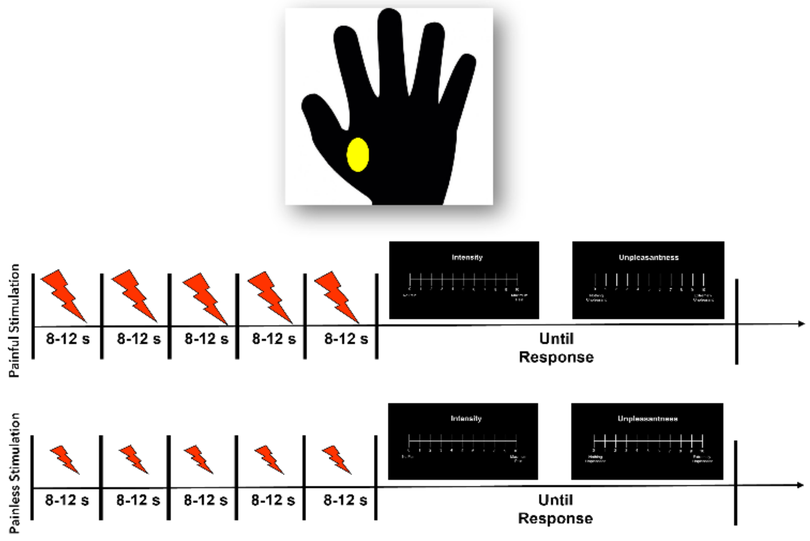
Materials and Methods

Participants. 27 pain-free older adults (13 male, mean age = 69.5, SD = 4), 23 older adults with chronic pain (8 male, mean age = 69.6, SD = 5), and 27 pain-free younger adults (14 male, mean age = 21.3, SD = 1.9).

Experimental design (see Figure 1). Subjective pain ratings and pain-ERPs were recorded. Participants received 6 blocks of 5 trains (3 pulses of 1ms duration, separated by 5ms) of painful electrical stimulation on the thenar eminence of the non-dominant hand. Pulse trains were individually adjusted to elicit a pain intensity of 4 ON a 0-10 numerical rating scale (NRS). There was an ISI of 8-12 s between stimulations. Moreover, similar blocks but with non-painful stimuli was presented. At the end of each block, participants assessed the pain intensity and unpleasantness felt.

Data analysis. 1. Sensory and pain threshold, as well as pain intensity eliciting a NRS=4 were analyzed with a univariate ANOVA (young vs. older VS. older with pain). **2.** Pain intensity and unpleasantness ratings were analyzed with a repeated measures ANOVA using STIMULATION (painful vs. non-painful) as within-subject factor and GROUP (younger vs. older vs. older with pain) as between-subject factor.**3.** P1, N1 and P300 amplitudes were analyzed with the same factors plus LATERALITY (left (C3), midline (Cz), right (C4). All comparisons were Bonferroni-corrected.

Fig. 1. Experimental design



Results

1. **Thresholds.** We did not found significant differences in pain thresholds and NRS= 4 analyses between groups (p>.05) (see Figure 2).

2. **Pain experiment.** No significant differences in pain intensity and unpleasantness ratings were found between groups (all ps>.05). In agreement, all participants rated the painful condition as more intense and unpleasant than the non-painful condition (all ps<.001) (see Figure 3). Pain stimuli elicited larger N1, P1 and P300 amplitudes than the non-painful stimuli in younger participants and older adults with chronic pain (all ps<.005). However, non-significant differences were found in the healthy older adults (p>.05) (see Figure 4). Pain-free younger participants showed larger N1 (p=.003) amplitudes than pain-free older adults, while no significant differences were found between pain-free younger and older adults with chronic pain (p>.05). In P300 we found that in the painful stimulation condition, pain-free younger participants and older adults with chronic pain showed larger P300 amplitudes than pain-free older adults (p=.001, p=.042, respectively). Finally, pain-free younger participants showed larger P300 amplitudes in the non-painful condition than pain-free older adults (p<.001) and adults with chronic pain (p<.001).

Fig. 2. Sensory and pain threshold and intensity eliciting a NRS=4

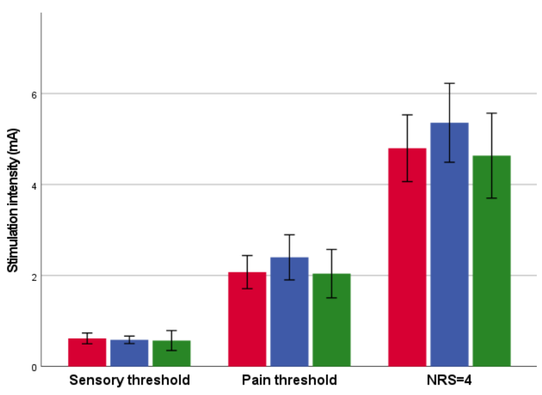


Fig. 3. Intensity and unpleasantness pain ratings

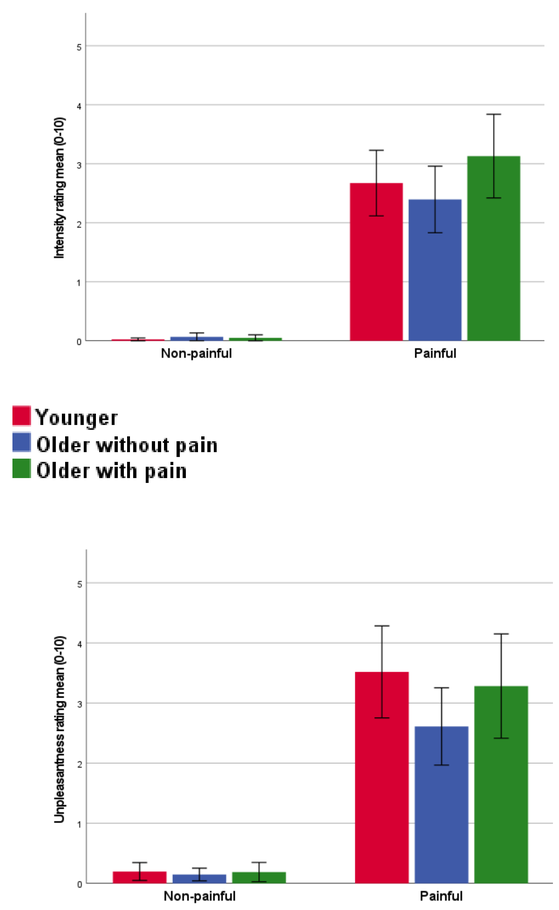
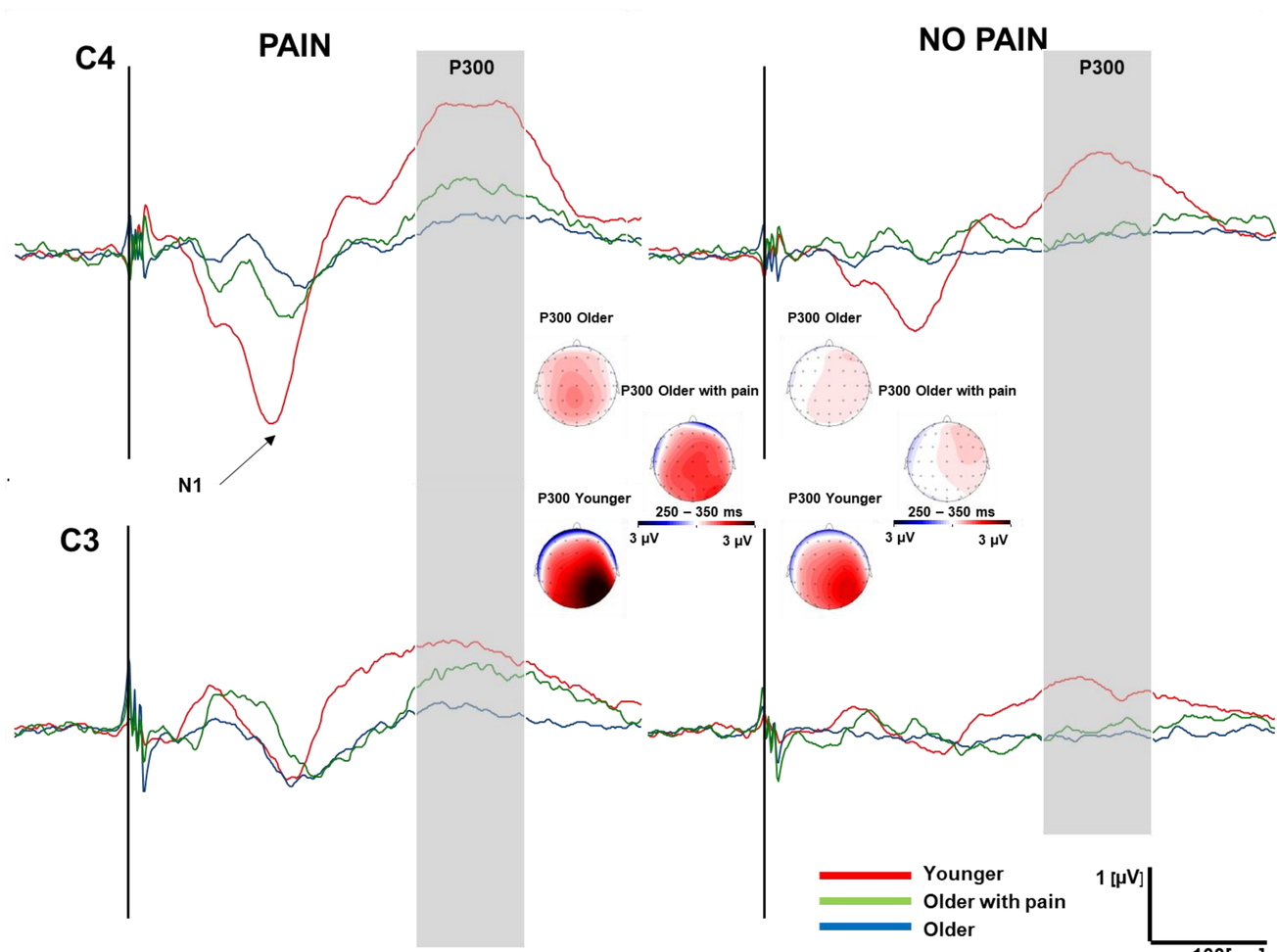


Fig. 4. ERPs by painful and non-painful stimulation



Conclusions

Older participants suffering from chronic pain showed a similar ERP pattern, for both painful and non-painful conditions, as older participants without pain in early latencies (flattened response in comparison to younger adults), but increased amplitudes in late evoked potentials. It is possible that the increased P300 amplitudes showed by the chronic pain group may be mirroring an augmented alarm/orienting response to the pain stimulation. Altogether, results suggest that plastic changes driven by suffering from long-lasting pain outweigh those triggered by the normal aging process, when both conditions coexist.

References

- Lautenbacher, S., Peters, J.H., Heesen, M., Scheel, J., Kunz, M., 2017. Age changes in pain perception: A systematic-review and meta-analysis of age effects on pain and tolerance thresholds. Neurosci. Biobehav. Rev. 75, 104–113. https://doi.org/10.1016/j.neubiorev.2017.01.039
- Patel, K. V., Guralnik, J. M., Dansie, E. J., & Turk, D. C. (2013). Prevalence and impact of pain among older adults in the United States: Findings from the 2011 National Health and Aging Trends Study: Pain, 154(12), 2649 2657. https://doi.org/10.1016/j.pain.2013.07.029

e-mail: alejandro.dorado1@estudiant.uib.cat

This study was supported by the Spanish Ministry of Economy, Industry and Competitiveness (PID2019-110096GB-I00 / AEI /10.13039/501100011033).