Validation of the Virtual Reality-PainCart: a randomized, placebo-controlled, two-way crossover study with diazepam

See all CHDR posters:

K.P.W. Rietdijk[1,2], I.W. Koopmans[1,2], R. Bohoslavsky[1], R.J. Doll[1,2], G.J. Groeneveld[1,2]*

[1] Centre for Human Drug Research, Leiden, The Netherlands.

[2] Leiden University Medical Centre, Leiden, The Netherlands.

ISRCTN: 16108471

Introduction

A previous VR-PainCart study lowered the Pain Detection Threshold (PDT) and enhanced unpleasantness by creating a virtual wound during an electrical pain test, thus modulating the affective component of pain. This provides a novel tool to investigate pharmacological compounds modulating this component.

Diazepam, an anxiolytic, reduces cerebral blood flow to temporal regions and influences emotional processing. The exact mechanism is unknown, but diazepam can be used to dull emotional processing and response – such as those created by a virtual wound.

Aims

1. Evaluate the impact of a VR-simulated wound during electrical stimulation on pain detection and tolerance thresholds (PDT and PTT).
2. Assess the effect of diazepam on electrical pain perception and the VR-induced changes.

Methods

- Two-way cross-over study with one-day visits, 7-day washout
- 24 healthy male subjects, 2 groups of 12
- Single oral dose of diazepam (5mg) or placebo
- 2 pre-dose set of tests and hourly post-dose recordings up to 6hrs
- Each set of tests includes: Electrical stair test (ramp from 0-50mA) followed by the same test within VR (but in alternating order), one enhanced a wound simulation (VR+) and one without (VR-)
- Questionnaires: *VAS (intensity and unpleasantness), McGill Pain Questionnaire (MPQ), Embodiment (VR experience)*

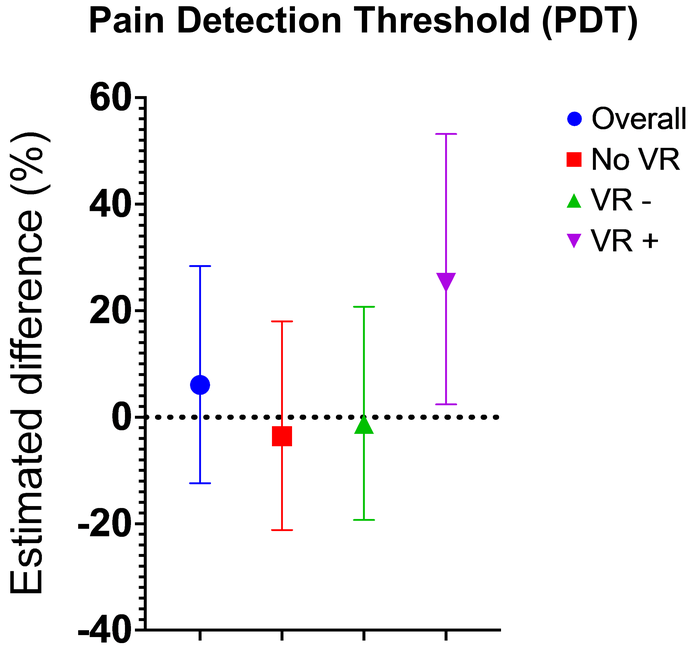
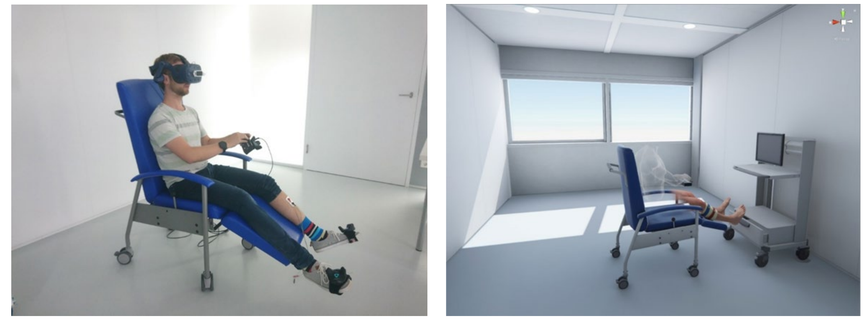


Figure 1: Pain Detection Threshold (PDT) Estimated difference (%) Diazepam vs placebo



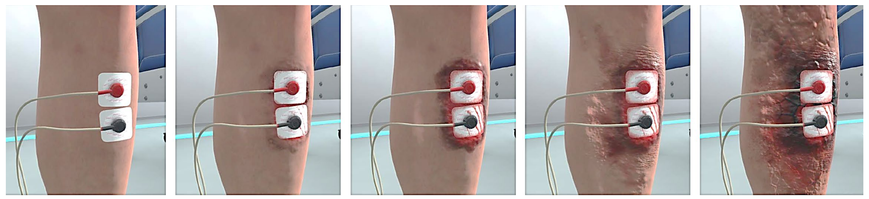


Figure 2: VR-environment (above) and simulated wound (below)

Results

Diazepam vs placebo Estimated Difference (ED):

- **PDT VR+:** 25.2%, (CI 2.4 – 53.2, *p = .03*)
- **PTT VR+:** 6.5%, (CI -3.1 – 17.0, *p = .18*)
- **Embodiment:**
  - **Movement control virtual body:** 0.2% (CI 0.0 – 0.5, *p = .03)*
- **VAS intensity:** -0.5% (CI -3.3 – 2.3, *p = .73*)
- **VAS unpleasantness:** 0.8% (CI -2.5 – 4.1, *p = .61*)
- **MPQ: Sensory:** -0.03% (CI -0.10 – 0.04, *p = .34*)
- **MPQ: Affective:** 0.04% (CI -0.04 – 0.13, *p = .32*)

Conclusions

- Validation VR-PainCart: proving pharmacological sensitivity and suitability as biomarker for affective component of pain
- Subjects showed a lower PDT in VR+ for placebo compared to diazepam. No significant changes were observed in PTT.
- Higher feeling of virtual body control in VR+

**Correspondence: Zernikedreef 8, 2333CL Leiden, 071-524 6400, ikoopmans@chdr.nl*

CHDR
Centre for Human Drug Research