

CHRONIC PAIN SUFFERERS EXHIBIT POORER NOXIOUS THERMAL DISCRIMINATION ABILITY COMPARED TO HEALTHY INDIVIDUALS

Chee-Wee, Tan¹; Shea Palmer³, Denis Martin², Patricia Roche¹.

¹School of Health Sciences, Queen Margaret University College, Duke Street, Edinburgh, EH68HF, UK.

²Centre for Health & Social Care Research, Sheffield Hallam University, Collegiate Campus, Sheffield, S102BP, UK.

³Faculty of Health Social Care, University of the West of England, Blackberry Hill, Bristol, BS161DD, UK

Background

Chronic pain sufferers have been shown to exhibit either higher pain thresholds or poorer discrimination ability [1,2], perhaps modulated by affect or cognition [3,4]. If chronic pain does induce altered performance on psychophysical tasks, the significance of such findings to clinical applications has yet to be established [5]. Presented here are the preliminary findings of a large scale clinical study comparing the noxious thermal discrimination ability of chronic pain sufferers and healthy individuals.

Methods

Subjects: 6 chronic low back pain subjects (mean age = 59 years, SD = 13; 2 women) from a clinical study and 6 healthy subjects (26 years, SD = 8; 2 women) from another study using a similar protocol.

Apparatus: A Thermostet Stimulator (Somedic AG, Sweden) was used to deliver three stimulus pairs, 45°C and 46°C, 46°C and 47°C, and 47°C and 48°C via a 25mm x 50mm thermode. Each subject underwent a total of 3 sessions conducted within the same day, each session testing the discrimination ability for one stimulus pair.

Procedures: At the beginning of each task, practice trials were administered. Seventeen trials per temperature were used during the actual trials. The experimenter instructed the subject to place his/her forearm on the thermode (set to the appropriate temperature). After three seconds, an auditory signal sounded indicating to the subject to remove the arm. If the subject was unable to tolerate the full length of stimulus application, they were allowed to withdraw their arm. The one-interval confidence rating task was administered and the subjects verbally rated their confidence that the higher of the two temperatures had been presented (Figure 1). Feedback was provided to the subjects after every trial. Subsequent stimuli were applied adjacent to the previous skin site in a clockwise manner.

Results

The signal detection theory index, d_a , was computed representing the discrimination ability [6]. Receiver operating characteristic (ROC) curves for each group were plotted from the pooled d_a scores (Figure 2). The ROC curves showed that the chronic pain sufferers showed poorer discrimination compared to the healthy individuals.

"1"	"2"	"3"	"4"	"5"	"6"
I'm absolutely confident that the weaker stimulus was presented	I'm fairly confident that the weaker stimulus was presented	I'm slightly confident that the weaker stimulus was presented	I'm slightly confident that the stronger stimulus was presented	I'm fairly confident that the stronger stimulus was presented	I'm absolutely confident that the stronger stimulus was presented

Figure 1. The chart used by subjects for discriminating between the two stimuli used within the task.

Figure 3 shows discriminability of all 3 stimuli pairs for both subject groups. The discrimination ability of chronic pain sufferers was poorer compared to healthy individuals for all the stimuli pairs. A mixed factorial ANOVA was performed with the subjects' age as a covariate in the analysis. There was a significant main effect of subject group ($F_{(1,9)} = 6.265, p = 0.034$). There were, however, no significant effects of the stimulus pairs or interaction effects ($p > 0.05$).

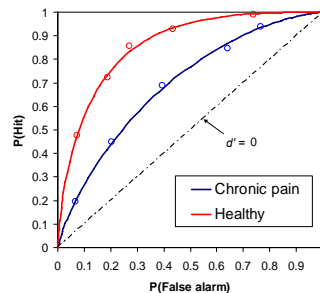


Figure 2 shows the receiver operating characteristic curves of the chronic pain and healthy subject groups based on pooled data of the three stimuli pairs. P(False alarm) was defined as the proportion that the subject judged 'higher temperature' when the lower temperature of the stimulus pair was presented. P(Hit) was defined as the proportion that the subject judged 'higher temperature' when the higher temperature was presented. The maximum-likelihood functions plotted through the points show that overall discriminability is lower for the chronic pain group (blue line) than the healthy group (red line).

Discussion

This preliminary study demonstrated that chronic pain sufferers exhibited poorer discrimination ability. It was not designed to explain the factors that produced such a finding, however, various factors, such as anxiety and depressive states, may contribute to this overall poor performance [3,4]. Similarly, the disruptive nature of chronic pain may reduce the sufferers' attentional ability to engage optimally in the task [7]. The larger scale clinical study, mentioned in the introduction, will examine the contributions of such affective and cognitive factors in the outcome of chronic pain sufferers' discrimination ability.

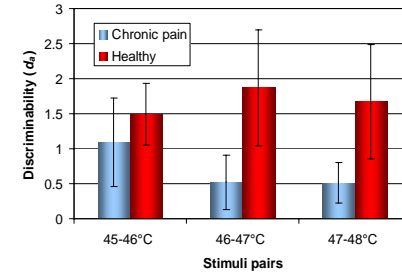


Figure 3. The discriminability of the 3 stimuli pairs for the chronic pain and healthy subjects. Discriminability of the healthy group for all 3 stimuli pairs was higher than that of the chronic pain group. The error bars represent the standard deviations.

Conclusion

This preliminary study showed that chronic pain sufferers display reduced discrimination ability compared to healthy individuals in a one-interval, confidence rating psychophysical task. This study also demonstrated that discrimination psychophysical methods may elucidate the decision-making performances within the context of pain research.

References

- [1] Cohen M.J. *et al* (1996) *Somatosens Mot Res*, 13:29.
- [2] Yang J.C. *et al* (1985) *Psychosom Med*, 47:461.
- [3] Malow R.M. *et al* (1989) *Pain*, 38:35
- [4] Villemure C. & MUSHNELL M.C. (2002) *Pain*, 95:195.
- [5] Gracely R. (1994) *Textbook of Pain*, Ch 17:315.
- [6] Macmillan N.A. & Creelman C.D. (2005) *Detection Theory: A User's Guide*, Ch 3:51.
- [7] Eccleston C. & Crombez G. (1999) *Psychol Bull*, 125:356.