Time-course and specificity of attentional bias in individuals with chronic headache: a discussion of the preliminary findings of two eye-tracking experiments

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Introduction

Individuals with chronic headache demonstrate significant attentional bias towards pain-related information (Liossi et al., 2009; 2011; Schoth & Liossi, 2010). The visual-probe task has been commonly used in such research, although is limited in that it provides only a snapshot of attention for each exposure duration used. Eye-tracking methodology is ideally suited for exploring attentional bias because it provides a continuous measure of attention and makes possible the study of spatial and temporal aspects of visual attention. Our current research therefore utilises eye-tracking technology to further explore visual attention in individuals with chronic headache in comparison to pain free controls. Below only the preliminary results of the headache group are presented.

An understanding of the temporal characteristics of attentional bias in chronic pain is important for both theoretical and clinical reasons. Biases may arise due to different cognitive processes, including hypervigilance for threat and/or a tendency to ruminate upon personally relevant information. Specificity of bias is also relevant, with theoretical models predicting cognitive biases towards information relating to an individual's concerns only (e.g. Beck et al.,1985). The paradigms adopted in the current investigation therefore presented a variety of pictorial stimuli to participants, including pain and headache-related images, and images of other negative, positive, and neutral facial expressions. The current research recorded eye movements in two computerised paradigms, exploring the time-course and specificity of bias in chronic headache In both tasks, individuals with chronic headache were hypothesised to show significant attentional bias towards relevant pain-related information.

Methods

Data from 21 individuals with chronic headache was available for analysis (mean age = 48.71 *SD* = 14.20; range 18 to 69 years; 15 female). Participants reported living with chronic headache for a mean duration of 19.9 years (*SD* = 12.02, range 5 to 40 years). Fourteen participants were suffering from tension headache, and 7 from migraine. Participants completed two computerised eye-tracking studies, the order of which was counterbalanced.

Visual-Scanning Task – Visual displays featuring painful, angry, happy, and neutral emotional expressions (see figure 1), were presented for 4 seconds. Participants were instructed to view the images as if 'looking at photos in a photo album'. Aside from this, the task featured no specific requirements, allowing participants to view the images in any fashion.

Visual-Probe Task – Headache-related/neutral and pain-related/neutral image pairs were presented for 500 and 1250ms. Following this, a dot replaced one of the images, which participants had to indicate the location of as quickly and accurately as possible (i.e. left or right).

Eye-tracking was measured using the EyeLink 1000 (SR Research), a desktop-mounted, high-resolution eye tracker. Movement was detected using corneal reflection of the right eye, with data sampled at 1000hz. For all of the displayed images, fixation frequency and duration were recorded.

Conclusions

In line with previous studies, individuals with chronic headache demonstrated an overall attentional bias towards pain-related information. For the first time, we demonstrated that individuals with chronic headache show bias in initial eye-movements towards pain-related information, which suggests a hypervigilance for such information. At the same time, however, in the visual-scanning task, individuals with chronic headache demonstrated an overall preference for happy expressions compared to pain expressions. It is possible that following initial hypervigilance individuals attempt to regulate their emotion by focusing on pleasant images.

Future eye-tracking research is planned, exploring biases in chronic headache and chronic orofacial pain, using a visual-search task and an anti-saccade task. The results of these will provide further detail on the specificity and time-course of attentional bias in different chronic pain populations.

Results

Visual-Scanning Task - For initial fixation location, a significant main effect of *image* was found, $F(3, 60) = 6.12$, $p = .001$, $\eta_p^2 = .23$. Post-hoc analysis revealed significantly more initial fixations towards *pain* expressions relative to *angry* ($p = .05$) and *neutral* ($p = .05$) expressions.

For total fixation location, a marginally significant main effect of *image* was found, $F(3, 60) = 2.68$, $p = .055$, $\eta_p^2 = .12$. Post-hoc analysis revealed significantly fewer fixations towards *pain* expressions relative to *happy* ($p = .04$) expressions.

For average fixation duration, a significant main effect of *image* was found, $F(3, 60) = 3.35$, $p = .03$, $\eta_p^2 = .14$. Post-hoc analysis revealed significantly shorter average durations towards *pain* expressions relative to *happy* ($p = .03$) expressions.

Visual-Probe Task – Participants made significantly more initial fixations towards *pain* images than their *neutral* counterparts, $t(20) = 2.09$, $p = .05$. No significant results were found with headache-related images.

Figure 1. Example of pain, angry, happy and neutral expressions included in the visual-scanning task (adapted from Simon et al., 2008)

References

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