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Attentional bias in injection phobia: Overt components, time course, and relation to behavior

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ABSTRACT

Blood-injection-injury (BII) phobia is an anxiety disorder that can cause serious health consequences by interfering with medical treatment. Although attentional bias for threat appears to be a core feature of many anxiety disorders and a potential target of treatment, very little is known about attentional bias in BII phobia. In the present study, eye movements were recorded in individuals high and low in injection fear (HIF, LIF) during 18-s exposures to stimulus arrays containing injection, attack, appetitive, and neutral images. Evidence for attentional vigilance was mixed, as HIF individuals oriented to injection images more often than LIF individuals, but did not orient to injection images more often than other emotional images. In contrast, evidence of attentional avoidance was highly robust. HIF individuals rapidly disengaged from injection images on initial viewing and viewed these images less overall compared to other image types, a pattern not observed in the LIF group. Furthermore, attentional avoidance of injection threat was found to uniquely predict behavioral avoidance on an injection behavioral avoidance task (BAT), and group differences on the BAT were mediated by group differences in attentional avoidance. The implications of these findings for further delineating the nature and function of attentional biases in BII phobia are discussed.

Blood-injection-injury phobia (BII) is a specific phobia characterized by extreme aversion to seeing blood or injuries, receiving injections, or undergoing invasive medical procedures (Öst, 1992). BII phobia is unique in that it is often characterized by vasovagal syncope ('emotional fainting') during exposure to threat-relevant stimuli (Öst, 1992; Sarlo, Palomba, Angrilli, & Stegagno, 2002). Another factor distinguishing BII phobia from other phobias is its potential health consequences. Individuals with BII phobia often delay or avoid medical procedures, which can cause serious health complications (Kleinknecht & Lenz, 1989; Öst, 1992) and has proven fatal in extreme cases (Hamilton, 1995). In light of the serious health implications of BII phobia, translational research that could inform the development of more effective treatments for this disorder is an important endeavor.

One promising area of translational research in anxiety disorders is the study of threat-related attentional biases. A large body of research suggests that anxious individuals preferentially process threatening stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007), leading to facilitated detection of threat (Öhman, Flykte, & Esteves, 2001) or increased maintenance of attention on threat (Fox, Russo, Bowles, & Dutton, 2001). These biases may contribute to anxiety by increasing distress and/or distraction during encounters with threat (Weierich, Treat, & Hollingworth, 2008). Indeed, computer-based training procedures that attenuate threat-related attentional bias may reduce symptoms of anxiety and improve functional outcomes (Hallion & Ruscio, 2011). Attention modification procedures focus on reducing the tendency to initially allocate attention toward threat. However, some studies have observed an additional attentional bias in anxiety disorders involving strategic avoidance of threat at later processing stages (Cisler & Koster, 2010). Such 'attentional avoidance' of threat may contribute to anxiety by preventing the extinction of fear and the reappraisal of threat (Cisler & Koster, 2010; Mogg & Bradley, 1998).

Although attentional biases have been observed in nearly every anxiety-related condition (Bar-Haim et al., 2007), very little is known about attentional biases for threat in BII phobia. Only a handful of studies have examined this topic, and several have reported null findings (Buodo, Peyk, Junghöfer, Palomba, & Rockstroh, 2007; Buodo, Sarlo, Codispoti, & Palomba, 2006; Sawchuk, Lohr, Lee, & Tolin, 1999; Wenzel & Holt, 1999). For example, BII phobics did not exhibit greater color-naming latencies for medical words in the emotional Stroop task (Sawchuk et al., 1999), nor did they respond faster to probes replacing BII-related words in a modified

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dot probe task with 500 ms word presentations (Wenzel & Holt, 1999). Although these studies employed the two most popular tasks for studying attentional bias in anxiety disorders, both employed lexical stimuli, which may not be potent enough to elicit biases. Also, the reaction time measures used in these studies focus on the initial allocation of attention toward threat. Given the extreme aversion to *perceiving* blood or injection in BII phobia, attentional avoidance of threat at later processing stages may be more relevant in this disorder. Indeed, simply viewing BII stimuli (Hellström, Fellenius, & Öst, 1996; Öst, Fellenius, & Sterner, 1991) has been found to considerably reduce symptoms of BII phobia, suggesting that attentional avoidance may be an important component of the disorder.

There is some evidence suggesting that BII phobia may be characterized by attentional avoidance. For example Tolin, Lohr, Lee, and Sawchuk (1999) found that BII phobics avoided viewing injection images compared to spider phobics and controls. However, viewing of injection images in this study was terminated with a manual response, as opposed to an attentional mechanism (e.g., disengagement). More compelling evidence of attentional avoidance *per se* was found by Mogg, Bradley, Miles, and Dixon (2004): using a modified dot probe task that employed images as opposed to words, these authors found attentional avoidance of threat in individuals high versus low in BII fear during 1500 ms stimulus presentations. In Mogg et al.'s study, the high BII fear group did not differ from the low BII fear group in their bias for threat in a condition employing 500 ms presentations, although within the high and medium BII fear group, but not the low BII fear group, there was increased vigilance for threat relative to non-threatening images. These findings are consistent with the proposed 'hypervigilant-avoidant' pattern of attention to threat (Mogg & Bradley, 1998) that has previously been observed in other phobias (spider phobia: c.f. Mogg & Bradley, 2006; Pflugshaupt et al., 2005; Rinck & Becker, 2006).

A hypervigilant-avoidant pattern of attention to threat in BII fearful individuals has also been observed in electrophysiological measures of neural activity. One line of research has focused on the N2pc, an event-related potential (ERP) linked to selective attention. Buodo, Sarlo, and Munafò (2010) found vigilance for BII stimuli compared to neutral stimuli in the early N2pc component, followed by reduced maintenance of attention on BII stimuli in the late N2pc component, in BII fearful participants. Although Buodo and colleagues interpreted this latter finding as avoidance of threat, the late N2pc occurs 240–310 ms after stimulus onset, far earlier than the avoidance observed by Mogg et al. (2004). Another ERP study (Sarlo, Buodo, Devigili, Munafò, & Palomba, 2011) found evidence of attentional avoidance of mutilation in BII phobics emerging at a later time interval, from 600 to 800 ms (but not from 800 to 1000 ms) in the late positive potential (LPP), a later ERP that is also thought to reflect attention. However, this study involved a serial image viewing context in which a reduced LPP may reflect stimulus reappraisal or other emotion regulation strategies in addition to selective attention (e.g., Dennis & Hajcak, 2009).

The hypervigilant-avoidant pattern of attention to threat that may characterize BII phobia could be better delineated through the application of eye tracking methodology. Eye tracking provides a direct and continuous measure of overt attention that is not susceptible to the potential confounds of manual reaction time measures and is not limited to the discrete, early time windows of ERP measures (Mogg, Millar, & Bradley, 2000; Weierich et al., 2008). In eye movement data, the initial orienting of gaze has been found to reveal vigilance for threat in a number of different anxiety disorders (e.g., social anxiety disorder: Gamble & Rapee, 2010; generalized anxiety disorder: Mogg et al., 2000; spider phobia: Rinck & Becker, 2006) and has shown convergent validity with reaction time measures of orienting (500 ms modified dot probe; Bradley, Mogg, & Millar, 2000; Mogg et al., 2000). In addition, eye tracking has revealed attentional avoidance on multiple time scales (e.g., 9 s, Pflugshaupte et al., 2007; 3 s, 60 s; Rinck & Becker, 2006) and may provide insight into the underlying components of attentional avoidance. For example, attentional avoidance may be achieved by maintaining one's gaze on a non-threatening stimulus, in line with the emotion regulation strategy of 'distraction' (Ochsner & Gross, 2005). However, when anxious individuals do look at threat, attentional avoidance may take the form of rapid disengagement, reflected in shorter fixations or glances on threat (Armstrong, Sarawgi, & Olatunji, 2012; Beevers, Lee, Wells, Ellis, & Telch, 2011).

Another feature of attentional bias in BII phobia that requires further investigation is the relation between attentional biases and behavior. Attentional biases have been found to uniquely predict important behavioral outcomes, such as relapse in individuals addicted to drugs (e.g., Marissen et al., 2006) and suicide attempts in individuals at risk for self-harm (Cha, Najmi, Park, Finn, & Nock, 2010). Although similar research is lacking in the anxiety disorders, attentional bias for threat has been found to uniquely predict increased stress reactivity (Fox, Cahill, & Zougkou, 2010) and behavioral avoidance related to contamination fear (Armstrong et al., 2012). One study found that attentional bias for threat failed to predict behavioral avoidance or treatment response in spider phobia (Lavy, van den Hout, & Arntz, 1993). However, no studies have examined the relations between attentional bias and behavioral avoidance in BII phobia. A unique relation between attentional avoidance and behavioral avoidance in BII phobia could reflect a common underlying mechanism, or it could suggest a causal influence of attentional avoidance on behavior, which would have implications for the etiology and treatment of BII phobia.

The present study focused on injection fear, which is one of the most common forms of BII phobia and may factor into other common BII fears (e.g., fear of dental procedures; Bienvenu & Eaton, 1998). Eye movements were recorded in individuals high and low in injection fear (HIF, LIF) during 18 s exposures to stimulus arrays containing injection, attack, appetitive, and neutral images. It was predicted that HIF individuals would be distinguished from LIF individuals by a hypervigilant-avoidant pattern of gaze to injection threat, as revealed by increased orienting toward injection threat, followed by rapid disengagement and sustained attentional avoidance of injection threat. Also, a behavioral avoidance task (BAT) involving a sham hypodermic needle was utilized to examine relations between injection fear, attentional avoidance of injection images, and behavioral avoidance. A model was tested in which group differences in injection-related behavioral avoidance are mediated by group differences in injection-related attentional avoidance.

Methods

Participants

Students in several large undergraduate classes ($N = 931$) completed the Injection Phobia Scale – Anxiety (IPS-anx; Öst, Hellstrom, & Kaver, 1992). Consistent with prior research (Olatunji, Smits, Connolly, Willems, & Lohr, 2007; Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002), individuals were recruited for the high injection fear (HIF; $n = 33$; IPS-anx $M = 44.06$, $SD = 10.15$) group if their IPS-anx score was higher than or equal to the IPS-anx patient mean, and they endorsed fainting symptoms or avoidance in response to BII-related stimuli. Individuals were recruited for the low injection fear (LIF; $n = 32$; IPS-anx $M = 3.47$. $SD = 3.05$) group if their IPS-anx score was lower than or equal to the IPS-anx healthy control mean.