Mechanisms Involved in Cognitive Control Training for Dysphoria

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Abstract

Cognitive Control Training (CCT) for depression using the Paced Serial Addition Task (PASAT) has resulted in the most consistent positive results. This study was conducted to replicate those results and test whether the key to positive outcomes was improved distress tolerance. Seventy-two participants were randomly assigned to 1 of 3 conditions, a waitlist control, and 2 treatment conditions. Participants in the treatment conditions were each given an electronic tablet to practice an attention task over a 2 week period. The tasks were exactly the same except that one was paced and time-pressured, the other was self-paced and less stressful (an active control). Overall, all groups displayed significantly fewer depressive symptoms at Time 2, and the time x condition interaction was marginally significant. We examined changes in distress tolerance throughout the study and found a significant effect for both time and time x condition. This study is able to give modest support for the assertion that practicing the PASAT as a form of CCT helps to decrease symptoms of depression, and part of that reason might be due to increases in distress tolerance.

Introduction

Cognitive models of depression have suggested that depression is caused, in part, by deficits in working memory and attentional control. Some have postulated that these deficits lead to an inability to control or stop repetitive negative thinking or rumination (De Lissnyder, Koster, Derakshan, & De Raedt, 2010; Hsu et al., 2015; Joormann, 2010; Siegle et al., 2014), which increases the likelihood that one will become depressed. Cognitive Control Training (CCT) draws from these theories regarding vulnerabilities to depression.

CCT was developed according to a neurobiological model of depression, which posits that some symptoms of depression are associated with hyperactivity of the amygdala (Drevets, 2003; Siegle et al., 2014; Siegle, Ghinassi, & Thase, 2007; van Eijndhoven et al., 2011) and decreased activity in specific areas of the prefrontal cortex (PFC; Siegle et al., 2007). These differences in brain functioning are thought to result in maladaptive thinking patterns. Hyperactivity of the amygdala contributes to increased negative affect and attention to negative information (Drevets, 2003; van Eijndhoven et al., 2011), while decreased activity in the PFC is thought to play a major role in attention control deficits (Hopfinger, Buonocore, & Mangun, 2000; Luks et al., 2010). This combination of amygdala activation and decreased activity of the PFC sets up a troublesome loop in which increases in negative affect and decreases in attentional control makes it difficult to distract oneself from negative experiences, resulting in ruminative thought (Siegle et al., 2007). It has been suggested that CCT stimulates activity in the dlPFC, while also inducing increased amygdala activity. In other words, increasing cognitive control while also under stress.

Among the different tasks used in the CCT literature, the PASAT has yielded the most consistent results. It is possible that the PASAT has been more effective than other interventions precisely because it addresses cognitive control while under stress. However, other mechanisms such as desensitization to negative emotions and potential increases in Distress Tolerance (DT) could also be operating.

The goal of the current study was to test the effects of the PASAT on symptoms of depression, while considering a few mechanisms that may underlie changes in depressive symptoms, notably AC, rumination, and DT.

Methods

Participants

- 72 students with BDI > 10 and no alcohol abuse
- Ages 18-44 (M = 21.79, SD = 5.71)
- 18 male, 52 female, 1 male to female transgender, 1 gender fluid

Procedure

Participants were recruited through an online survey. Those who responded to the invitation came into the lab and completed the BDI, Distress Tolerance Scale (DTS), Ruminative Response Scale (RRS), and the Sustained Attention to Response Task (SART). Those in the waitlist control condition left and returned to the lab 2 weeks following the first visit. Those in the training conditions were introduced to their training tasks and completed their first training session in the lab. Following the lab session, participants in the training conditions completed 5 additional training sessions on their own, then returned the lab 2 weeks following the initial visit.

During the second visit, participants completed the same questionnaires as the first visit. They completed the attention task and were debriefed at the conclusion of the study.

Results

The hypothesis that practicing the PASAT would lead to decreased symptoms of depression was tested by entering BDI scores into a 3 (condition) x 2 (time) mixed factorial ANOVA. Age was entered as a covariate. The main effect for time was significant, in that overall, all groups displayed significantly fewer depressive symptoms at T2, $F(1, 68) = 10.56$, $p < 0.01$, $h_p^2 = 0.13$. The main effect for condition was not significant $F(2, 68) = 0.03$, $p = 0.97$, $h_p^2 = 0.04$. The time x condition interaction was marginally significant, $F(2, 68) = 2.81$, $p = 0.07$, $h_p^2 = 0.08$. See Figure 1.

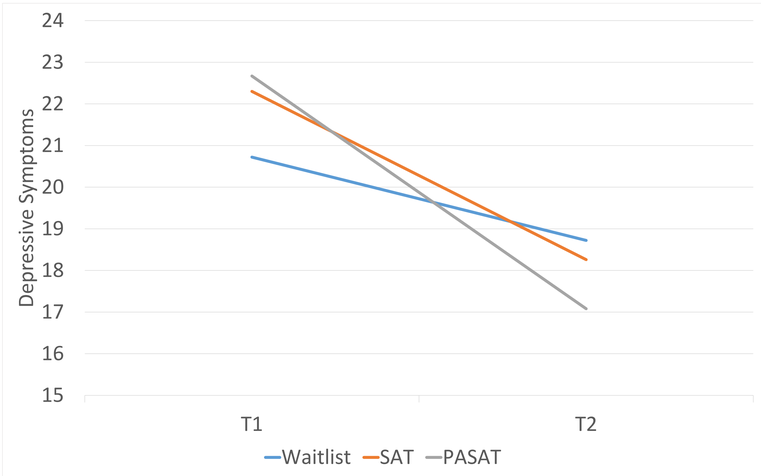

Figure 1. Mean values of BDI at T1 and T2 (by condition).

The hypothesis that practicing the PASAT would lead to increase DT was tested by entering DTS scores into a 3 (condition) x 2 (time) mixed factorial ANOVA. Age was entered as a covariate. The main effect for time was marginally significant, in that overall, all groups displayed significant increases in DT at T2, $F(1, 68) = 13.71$, $p < 0.06$, $h_p^2 = 0.13$. The main effect for condition was not significant $F(2, 68) = 1.37$, $p = 0.25$. The time x condition interaction was significant, $F(2, 68) = 3.62$, $p = 0.03$. See Figure 2.

Similar ANOVAs were run to examine differences in RRS and SART; however, none of the results were significant (all *ps* > 0.05).

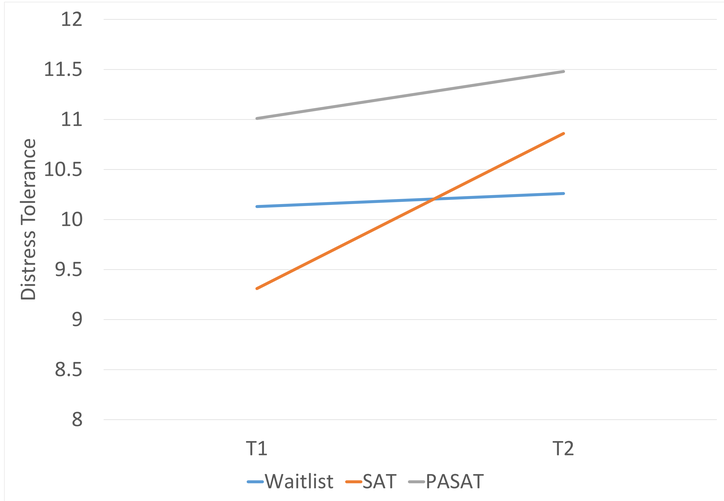

Figure 2. Mean values of DTS at T1 and T2 (by condition).

Conclusion

Though the primary hypothesis of this study had only modest support, it is consistent with other findings that show that CCT might be an effective means for reducing symptoms of depression. It was also found that there was a condition which appeared to increase distress tolerance in dysphoric individuals. This finding was unexpected (it occurred in the condition which was expected to *not* be distressing), yet it could be an interesting new area to study. While it is irrefutable that depressed individuals experience a great deal of distress, there is scant literature on distress tolerance in individuals with depression. Studies like this one are needed to help fill that gap in the literature that should be explored by researchers to examine the relationship between DT and depressive symptoms, as well as the possibility that increasing DT could be helpful for depressed individuals.

[1]Additional analyses were completed following the acceptance of this poster which changed the results and conclusions, making them different than the abstract that was initially submitted.

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