Attention Bias Modification with or without Reward for Social Anxiety Disorder

A randomized controlled trial

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HÁSKÓLI ÍSLANDS

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Sálfræðideild
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Contents

Abstract

Attentional bias modification (ABM) is a new treatment option for anxiety that involves implicitly modifying attention away from threat-related stimuli with a computerized *dot-probe* task. Participants were 27 individuals with social anxiety disorder who received cognitive-behavioral group therapy (CBGT) at an outpatient anxiety treatment center. It was hypothesized, first, that adding ABM to CBGT would have a greater effect on social anxiety symptoms and attention bias (AB) compared to CBGT alone. Second, it was hypothesized that adding reward, which has been shown to influence attention on visual search tasks, to CBGT would result in greater treatment gains than CBGT. Results did not indicate that ABM or reward, or the combination of the two, added anything to the CBGT as a treatment for SAD patients. Further research on these processes is needed for a better understanding on how they work, and hopefully discover ways to find the most successful way to treat individuals suffering from SAD.

Social Anxiety Disorder

Social anxiety disorder (SAD) is the fear of being humiliated or embarrassed in social situations (American Psychiatric Association, 2000). SAD is one of the most common and pervasive class of psychiatric disorders, and has been estimated as the second most common psychiatric disorder (Kessler, Chiu, Demler and Walters, 2005). SAD is usually impairing and associated with decreased quality of life (Stein & Kean, 2000) and increased risk of suicide (Cougle, Keough, Riccardi & Sachs-Ericsson, 2009).

Cognitive models of SAD suggest that socially anxious individuals have attentional biases towards threatening stimuli. They often feel that other people pass judgment on them and this shifts their attention towards closely monitoring themselves, increasing their awareness of their own anxiety responses. At the same time they center on possible cues of negative evaluation by others, such as frustrated or angry facial expressions, a yawn or other signs of boredom. The dysfunctional beliefs and the fear of being evaluated negatively, creates behavioral, cognitive and physical symptoms of anxiety. The symptoms of anxiety make individuals with SAD turn to monitoring themselves closely and, dreading evaluation by others, they monitor the environment in search for cues of negative evaluation. This creates a series of vicious cycles that maintain SAD (Beck, Emery & Greenberg, 1985; Clark & Wells, 1995; Rapee & Heimberg, 1997).

Attentional bias

Attentional bias has been described as either attending faster to threat-related stimuli in the environment than to neutral stimuli (facilitated engagement) or as having difficulty disengaging from threatening stimuli once they have captured attention (delayed disengagement). The latter phenomenon has received greater support from various studies than the first as describing a core maintenance factor in anxiety disorders (Amir, Elias, Klumpp, & Przeworski, 2003; Cisler & Olatunji, 2010; Mogg, Philippot, & Bradley, 2004).

AB can be measured both above (supraliminal) and below the threshold for conscious perception (subliminal). It has been argued that the modified Stroop task (Stroop, 1935) measures supraliminal AB, while a dot-probe task (MacLeod, Mathews & Tata, 1986) measures subliminal AB (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg & Van Ijzendoorn, 2007). Stroop task and the dot-probe performance do not correlate, which suggests that the two tasks measure different aspects of attention (Dalgleish, Taghavi, Neshat-Doost, Moradi, Canterbury & Yule, 2003). The dot-probe task is a task, normally submitted through a computer. Two stimuli are presented and following a certain time the stimuli disappear (e.g. 250 msec. or 500 msec.), and a target probe is presented in the location occupied by one of them. Participants respond, as fast as possible, denoting which stimulus was replaced. AB towards threat is revealed when participants respond faster to probes that replace threat-related rather than neutral cue stimuli; the frequency with which the probe replaces the treat-related and neutral stimuli is equal.

Treatments for SAD

One of the most studied treatments for SAD is cognitive behavioral group therapy (CBGT), which primarily involves behavioral experiments with integrated exposure in social situations with cognitive restructuring (Heimberg, Dodge, Hope, Kenedz & Zollo, 1990, Heimberg et al., 1998). Approximately 75% of those undergoing CBGT for SAD respond positively to treatment (Heimberg et al.1998). Even though attention plays an important role in cognitive models of social phobia, (see Clark & Wells, 1995; Rapee & Heimberg, 1997), CBGT does not focus specifically on patients' attention. On the other hand it seems that some sort of attention modification is involved in the process of exposure treatment, often included in CBGT. When patients who receive the treatment are instructed to maintain focus on the external environment (e.g. on the people around them), instead of their own feelings of distress, the treatment tends to be more successful (Wells & Papageorgiou, 1998).

Attentional bias modification

Recently, a new treatment option for anxiety has been developed; attentional bias modification (ABM). The aim of ABM is to modify AB by training participants to direct their attention away from threat-related cues and towards neutral cues, and as a result, reduce anxiety symptoms (Hakamata et. al., 2010; Hallion & Ruscio, 2011). The core idea is that attention patterns in anxious individuals can be manipulated with a simple cognitive task such as the dot-probe task (MacLeod, Mathews & Tata, 1986). In a dot-probe task, the frequency with which the probe replaces the threat-related stimulus is manipulated. The target probe replaces the neutral stimuli in 80-100% of the trials instead of 50%. This is done to induce selective processing of neutral cues when these cues compete for resources with threat-related cues. During the course of many trials the participants start to implicitly learn to disengage from threat and direct their attention towards neutral stimuli. ABM training often results in reduced self-report anxiety symptoms in both non-clinical (Amir, Weber, Beard, Bomyea & Taylor, 2008) and clinical samples (Amir et al., 2009).

Schmidt, Richey, Buckner & Timpano (2009) found ABM to be an effective intervention for SAD; 72% of participants no longer met DSM criteria for SAD post-treatment, compared to 11% of control participants. These gains were maintained at four-month follow-up tests. Amir et al. (2009b) found similar results using the same procedure in a group of individuals with generalized social phobia. After eight 20-min sessions spread over a four-week period, 50% of participants in the treatment group no longer met diagnostic criteria post treatment versus 14% in control group. Treatment gains were maintained at the four-month follow-up. A similar study conducted by Klumpp and Amir (2010), where participants gave an impromptu speech in front of a camera after receiving training. Their results demonstrated that participants who were trained to focus attention away from threat were less anxious after performing the unprepared speech, as well as participants trained to

focus attention towards threat, than a control group. These findings raise numerous questions about how ABM affects anxiety and whether reactivity due to ABM depends on the type of stimuli used in the training task or on the types of stressor task performed after the training. Attention training towards positive portraits has for example not proved as effective in reducing anxiety in social anxious individuals as using threatening and neutral portraits (Li, Tan, Qian & Liu, 2008).

Carlbring et al. (2012) studied the effects of delivering ABM to participants' home via the internet instead of doing it in the traditional clinical setting. They used exactly the same procedure as the experiment conducted by Amir et al. (2009b) except there, participants were trained in a special clinic, while Carlbrings' patients were trained at home. No differences between the ABM and control conditions were found. Rapee et al. (2013) also studied the effects of ABM delivered in home settings, but as an addition to CBGT. Their results indicated that ABM does not provide additional benefits beyond CBGT. The reason for these non-significant differences may be that ABM was delivered in a home-setting without careful observations on interferences or other things that may have occurred during ABM.

Further investigation on the mechanisms underlying AB and ABM are needed for a better understanding of these processes, which would hopefully have treatment implications.

Positive reinforcement and priming

When an outcome of a certain action or behavior increases the likelihood that the behavior will later be repeated, it is called positive reinforcement. Recently, the effects of a reward, or positive reinforcement in visual search tasks have been investigated. Kiss, Driver and Eimer (2009) demonstrated that visual processing can be influenced by the worth of the reward, but response times on a visual search task were shorter when the reward was higher (5 bonus points), than when the reward was lower (1 bonus point). Kristjánsson, Sigurjónsdóttir, and Driver (2010) studied the effects of reward on priming in visual search tasks. Priming has

been said to reflect processes found in attention mechanisms (Kristjánsson, Sævarsson, Driver, 2013). It occurs when what we observe in our environment is unconsciously influenced by something we have previously seen and makes processing of that feature (e.g. the color or the position of an object) faster and easier (e.g. Kristjánsson, 2008). Their results demonstrated that when participants received high rewards for correct answers on a visual search task, priming effects were significantly higher than for smaller rewards. The effects of reward on attention in ABM have not been studied before, and whether giving high reward for a task involving neutral rather than threatening faces may reduce SAD symptoms.

Aims and hypotheses

The aims of the current study were the following; to examine whether adding ABM to CBGT for individuals with SAD leads to increased effectiveness compared to CBGT alone, and to assess whether higher positive reinforcement for neutral versus threatening faces adds to the effectiveness of ABM.

The hypotheses are as follows:

1) ABM and CBGT have a stronger effect upon SAD symptoms and attentional biases towards threatening stimulus than CBGT alone.
2) Providing higher reward for neutral than threatening faces to CBGT is more effective with regard to SAD symptoms and attentional biases towards threatening stimuli than CBGT alone.

In addition to these explicit predictions, our design allows us to assess any interaction between the two main experimental manipulations.

Method

Participants

Individuals seeking group therapy for social anxiety at an outpatient anxiety treatment center in Reykjavík, Iceland were tested. Those who met DSM-IV criteria for SAD and were deemed appropriate for group therapy were invited to participate in the study. Those who agreed to participate were given an explanation of the process and advised not to take any sedatives or consume alcohol to minimize anxiety before attending therapy sessions. Participants who were taking daily psychotropic medication were advised not to change dosage during the course of the therapy. Information on how many participants took daily psychotropic medications is not available. All participants had normal, or corrected, eyesight and were right-handed.

The intent-to-treat sample consisted of 37 participants between the ages of 18 and 56. The sample was a convenience sample and the participants were volunteers who paid a modest fee for the CBGT treatment. Participants were randomly assigned to four groups, all of which received CBGT; a group that received ABM with reward manipulation towards neutral stimuli, a group that received ABM without a reward manipulation and two control groups; one that only received reward manipulation but not ABM, and another one that received neither ABM nor reward manipulation. Participants who were in a reward condition earned 10 points, 75% of the time when they correctly pressed the right key as a neutral image appeared before the target probe but only 25% of the time following a threatening stimulus. For other participants, points were earned in a random fashion.

Equipment

Custom-made software, programmed in C, was run on an iMac G3 Macintosh computer. The 20th edition of the software SPSS was used to analyze the data.

Measures

Social Phobia and Anxiety Inventory – SPAI (Turner, Beidel, Dancu & Stanley, 1989) is a 45-item self-report inventory that measures social anxiety symptoms on a 7-point Likert scale: 1 (*never*) to 7 (*always*). A social-phobic subscale composes 32 items and an agoraphobic subscale 13, and a total score is derived by subtracting the Agoraphobia subscale from the other. The Icelandic version has good discriminant and convergent validity (Smári, Clausen, Hardarson & Arnarson, 1995).

Social interaction anxiety scale –SIAS (Mattick & Clarke, 1998) is a 20-item self-report inventory designed to assess fear related to social interactions on a 5-point Likert scale: 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*). Psychometric properties of the Icelandic translation are good ($\alpha = 0.91$), as well as having good discriminant validity (Ólafsdóttir, 2012).

Social Phobia Scale – SPS (Mattick & Clarke, 1998) is a 20 item, self-report inventory designed to evaluate the fear of being observed by others, rated on a 5-point Likert scale: 0 (*not at all characteristic of me*) to 4 (*extremely characteristic of me*). Psychometric properties of the Icelandic translation are good, with Cronbach's alpha over .80, as well as reliably discriminating between individuals with and without SAD (Ólafsdóttir, 2012).

The Liebowitz Social Anxiety Scale- LSAS (Liebowitz, 1987) is a self-report scale containing 24 descriptions of different social situations. Participant rate fear and avoidance on a 0-3 point Likert scale for each social situation. The psychometric properties of the scale are good, with a Cronbach's alpha above .80 (Heimberg et al., 1999). Psychometric properties of the Icelandic translation used in this study have not been formally evaluated.

The Posner task (an emotional spatial cuing task; Posner, 1980) is a computer-presented experimental task to measure attentional bias. A threatening or non-threatening cue is presented in either of two places on a screen, and most often a target stimulus appears

where the cue appeared (valid cue), but sometimes the target appears at a different place than the cue (invalid cue). AB is indicated by a shorter response time on valid, threatening cue and by a longer response time on invalid, non-threatening cues. Facilitated engagement is indicated by shorter response times on invalid cues and delayed disengagement is indicated by a longer response time on invalid cues (Posner, 1980).

Stimuli

Posner task. Fifty by fifty mm. frames appeared on a black screen on the left or right side of a white cross stationed in the middle of the screen, 25 mm from the white cross (fixation point). Words appeared in the middle of one of the frames for 600.62 msec. There was a total of eight words, four threatening and four neutral words that had a similar appearance and length as the threatening words. The target was a 5 x 5 mm white rectangle that appeared inside the center of the other frame when the word disappeared.

Dot-probe task. Fifty-eight by fifty mm. (facial) portraits appeared for 480.35 msec on a black screen, 25 mm above and under the white fixation cross in the center of the screen. The portraits were chosen from the database *Radbound Faces Database* (RaFD) and the faces were either expressing disgust or having a neutral expression. The photos were all of Caucasian adults, 20 males and 19 females, from the Netherlands (Langner, Dotsch, Bijlstra, Wigboldus, Hawk & van Knippenberg, 2010). The target stimulus was 5 mm white arrow that pointed left or right. The arrow appeared 25 mm from central fixation.

Design

A double-blind 2x2 design was used where the independent variable is: 1) Target stimulus that takes two values, either ABM or no modification; 2) Reward schedule that can take two values: either biased towards neutral stimuli, where ten points are given 75% of the time when target stimulus appears behind a neutral stimulus, or non-biased where points are distributed

randomly. Dependent variables were 1) response-time in milliseconds and 2) results from self-report inventories assessing social anxiety symptoms. The experiment is based on within- and between-group comparisons.

Cognitive Behavioral Group Therapy

Two therapists conducted a 2-hour CBGT sessions, once a week for 10 weeks. Participants were in groups of ten to twelve and therapists were blind to which condition their patients were in. Components of the treatment included elements from the theory derived cognitive treatment by Clark and Wells (1995) and Heimberg and Becker (2002), specialized for SAD. A part of the intervention was informing patients about safety behaviors, the role attention plays in the disorder and training them how to manipulate the two. Biased pre- and post-event processing was targeted, patients participated in role-playing, performed speeches and later evaluated their own video-recorded performance from an objective perspective. Special tasks were assigned after each session, which patients were to complete at home and later inform other patients in the group session about them.

Procedure

The experiment was approved by the institutional ethics committee in Iceland (*is.* Vísindasiðarnefnd). The first part of the data collection for the study was conducted in the spring of 2011, recruiting 23 participants seeking group therapy for social anxiety at an outpatient anxiety treatment center in Reykjavík, Iceland. The second part of the data collection was conducted in the winter 2012-2013, with 14 participants. A licensed clinical psychologist interviewed all potential participants at baseline and determined whether they met DSM-IV criteria for SAD and were deemed suitable for group therapy. Every participant was asked if they had normal vision and whether they were right- or left handed. All agreed to participate in the experiment and completed the five self-rating anxiety scales, previously

mentioned. For some participants in the first experimental group, CBGT was conducted alongside AMB sessions, while for others ABM was conducted following the CBGT. The reason for this inconsistency was because participants were collected over a two- month period so some were further along in the treatment than others when ABM was conducted. In the second experimental group, ABM sessions started in the third CBGT session and were either completed before, or after the session. During ABM participants sat down in front of a computer screen and received verbal instructions on how to complete the upcoming tasks. The first computer task (Posner task; word-cues) was to measure AB. The participant's task was to indicate, as fast as possible, by pressing special keys on the keyboard, in which frame the white box appeared. The second computer task, The Dot-Probe task (picture-cues), was to modify attention and participants were to indicate, as fast as possible, in which direction the arrow was pointing, left or right, by pressing corresponding keys on the keyboard. Participants randomly earned points for a correct answer during the task, which they could later use as a credit at the anxiety treatment center, to pay for their CBGT sessions. For participants in the reward condition, 10 points were earned 75% of the time for giving correct answers when a neutral image appeared before the target probe, but only 25% of the time when a threatening stimulus preceded the target probe. The three participants with the fastest response time would earn bonus prices.

There were 80 trials in the Posner task, and 107 trials in the dot-probe task. Both tasks had to be repeated twice and participants could take a break between repetitions. ABM sessions were 8-16 in total, each session taking around 20-30 minutes. In the first and last session, participants completed four questionnaires to evaluate their SAD symptoms.

Statistical Analyses

The main dependent variables were changes in social anxiety as measured by the SPAI, SIAS, SPS and the LSAS. AB was measured by the Posner task. Reduced AB and reduction in

scores of the four anxiety scales after participant receives ABM in addition to CBGT, than when they receive CBGT alone, would indicate that adding ABM to a traditional CBGT for SAD patients is more effective. Greater reduction in AB and scores of the anxiety scales when reward is added to CBGT, compared to CBGT alone, would demonstrate that adding reward to CBGT would be superior.

The main analysis was based on treatment completers rather than on all the participants who started treatment (ITT, intent-to-treat approach) since there were multiple reasons for the dropout and technical difficulties explained missing data for some participants who finished treatment (8%). The ITT approach assumes that participants with missing data did not receive the intended treatment and any effect would therefore be underestimated. Figure 1 presents a flowchart of the study. To ensure that there were no group differences in demographic characteristics or symptom severity, chi-square tests for categorical variables was conducted as well as ANOVA tests for continuous variables comparing groups at pre-treatment.

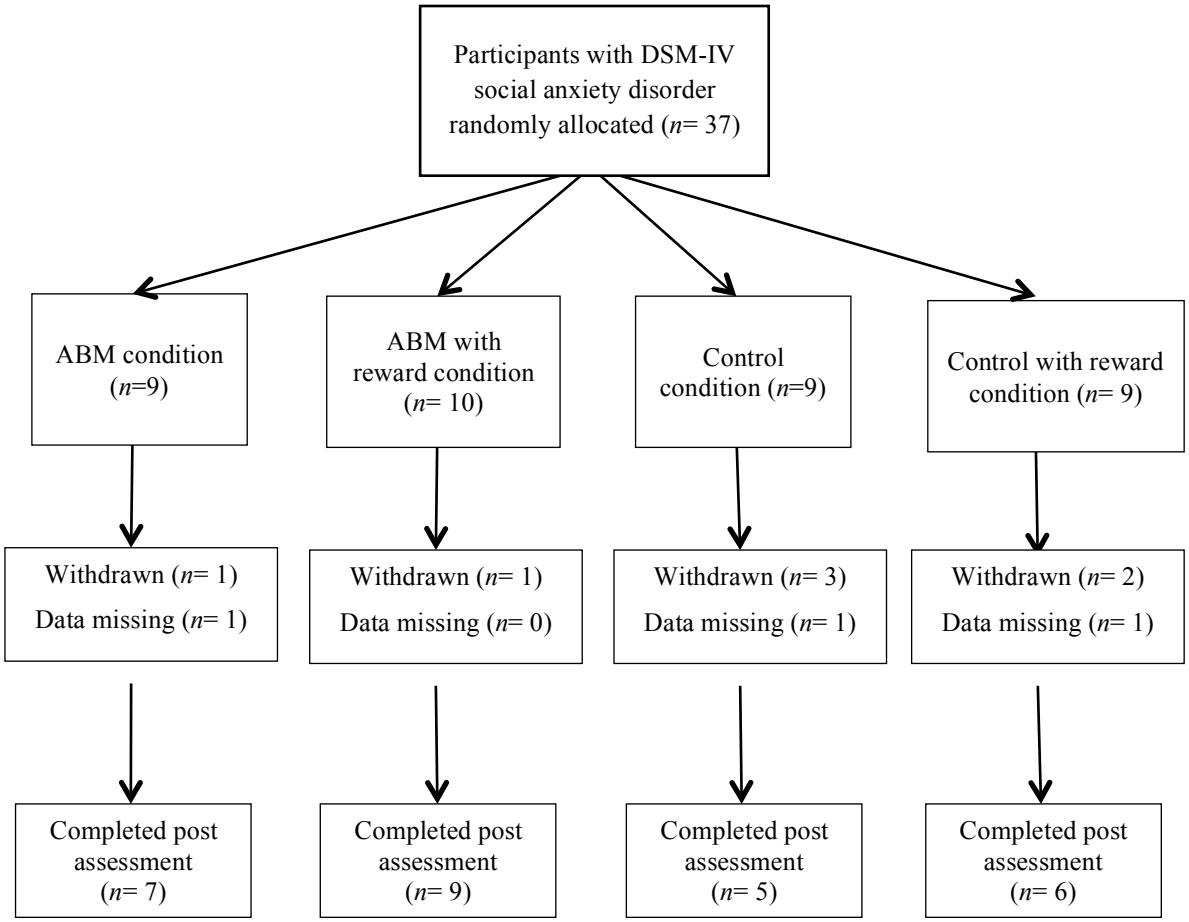

Figure 1. *A flowchart of the study*

To examine effects of ABM upon AB towards threat, participants‘ response latencies on the modified Posner task, were submitted to a 2 (ABM: participants who received ABM, participants who did not receive ABM) x 2 (word type: social threat, neutral) x 2 (trial value: invalid, valid) x 2 (time: pre-assessment, post-assessment) analysis of variance (ANOVA) with repeated measurement on the last three factors. A separate 2 (Reward: participants who received reward, participants who did not receive reward) x 2 (word type: social threat, neutral) x 2 (trial value: invalid, valid) x 2 (time: pre-assessment, post-assessment) analysis of variance (ANOVA) was conducted to examine the effects of reward upon attention bias towards threat.

To determine the effects of ABM and reward in the reduction of symptoms following treatment we conducted 2 (ABM) x 2 (time) and 2 (reward) x 2 (time) repeated measure ANOVAs with the social phobia questionnaires (SPS, SIAS, SPAI and LSAS) data as dependent variables and ABM and reward as the between-subjects factors. To evaluate treatment results, effects sizes were calculated and reported as partial eta-squared for ANOVAs and Cohen's *d* for scale measures (Cohen, 1988). Alpha-levels for null-hypothesis rejection were set at $p < .05$ throughout.

Results

Baseline Profile

A total of 37 participants were randomized to one of four conditions, and of 27 of those completed the study. A Chi-square test revealed a significant gender difference between reward groups (participants who received reward and those who did not), $\chi^2(1, 27) = 4{,}20$, $p = .04$, which could be due to more females receiving reward than males. There was no gender difference between ABM groups, $\chi^2(1, 27) = .76$, $p = .384$. A one-way ANOVA revealed that there was no age difference between AMB, $F(1, 25) = .005$, $p = .945$, or reward groups, $F(1, 25) = 1.04$, $p = .32$.

There were no differences between reward groups on pre-assessment scores on SPS, $F(1, 25) = 1.25$, $p = .28$, SIAS; $F(1, 25) = 0.41$, $p = .53$; SPAI, $F(1, 25) = 0.121$, $p = .73$; and LSAS, $F(1, 25) = 0{,}23$, $p = .63$. Likewise there were no differences between ABM groups on pre-assessment scores on the four SPS scales [SPS, $F(1, 25) = .001$, $p = .973$; SIAS, $F(1, 25) = 1.04$, $p = .32$; SPAI, $F(1, 25) = .23$, $p = .640$; and LSAS, $F(1, 25) = .402$, $p = .53$].

Descriptive data for participants are presented in Table 1. There were discrepancies in number of weeks since end of CBGT between conditions as some participants had already finished the CBGT before participating in the study.

Table 1. *Baseline mean demographics and standard deviations*

	ABM with reward (n=9)	Control without reward (n=5)	ABM without reward (n=7)	Control with reward (n=6)
Age	30 (12)	36 (11)	32 (13)	27 (7)
Number of females (%)	7 (78%)	3 (60%)	2 (29%)	5 (83%)
No. of weeks since end of CBGT	1 (1)	2 (2)	1 (1)	0 (0)

Attentional bias

Boxplots and response distributions were inspected for outliers. Consequently response times under 100 msec. and over 1000 msec. were discarded as outliers as well as response times from trials with incorrect responses. A total of 186 response times were excluded or 2.1% of the original dataset leaving 8.743 valid response times. RT data on the Posner task were subjected to a mixed model analysis of variance (ANOVA) to evaluate main effects of cue word (neutral or social threat), trial value (invalid or valid), time (before and after treatment), ABM group (ABM or no ABM), and reward group (reward, no reward). Kolmogorov-Smirnov test and Test of Homogeneity of variance showed that the distribution of RT scores was significantly different from normal and inhomogeneous. Transforming the data did not make a difference. Results should therefore be interpreted with caution.

Response times on the Posner task, used to measure attention bias towards threat, from pre- to post assessment are presented in Figure 2 for the ABM group and 3 for the Reward group. Results revealed a significant main effect for cue type, $F(1, 23) = 12.1$, $p = .002$, $\eta^2_p = .34$, such that when controlling for other variables, RT tended to be shorter for threatening cue words than for neutral cue words. There was a significant effect of Trial value, $F(1, 23) = 8.9$, $p = .007$, $\eta^2_p = .28$ with RT being shorter on invalid trials than on valid trials. There was also a

significant main effect of Time, $F(1, 23) = 27.54$, $p < .001$, $\eta^2_p = .55$, which indicated that participants had a shorter RT from pre- to post assessment. The main effect of ABM group, $F(1, 23) = .25$, $p = .62$, $\eta^2_p = .011$, and Reward group, $F(1, 23) = .417$, $p = .42$, $\eta^2_p = .03$, were not significant. There was no significant Time × ABM interaction, $F(1, 23) = 0.12$, $p = .735$, $\eta^2_p < .01$, or Time × Reward interaction, $F(1, 23) = .636$, $p = .433$, $\eta^2_p = .03$, effect. ABM × Reward interaction effect, $F(1, 23) = .011$, $p = .92$, $\eta^2_p = .00$, was not significant. There was a significant interaction effect on the relationship between Time and Trial value, $F(1, 23) = 4.52$, $p = .044$, $\eta^2_p = .164$, whereas there was a greater reduction in RT post-assessment on invalid trials compared to valid trials from pre- to post assessment.

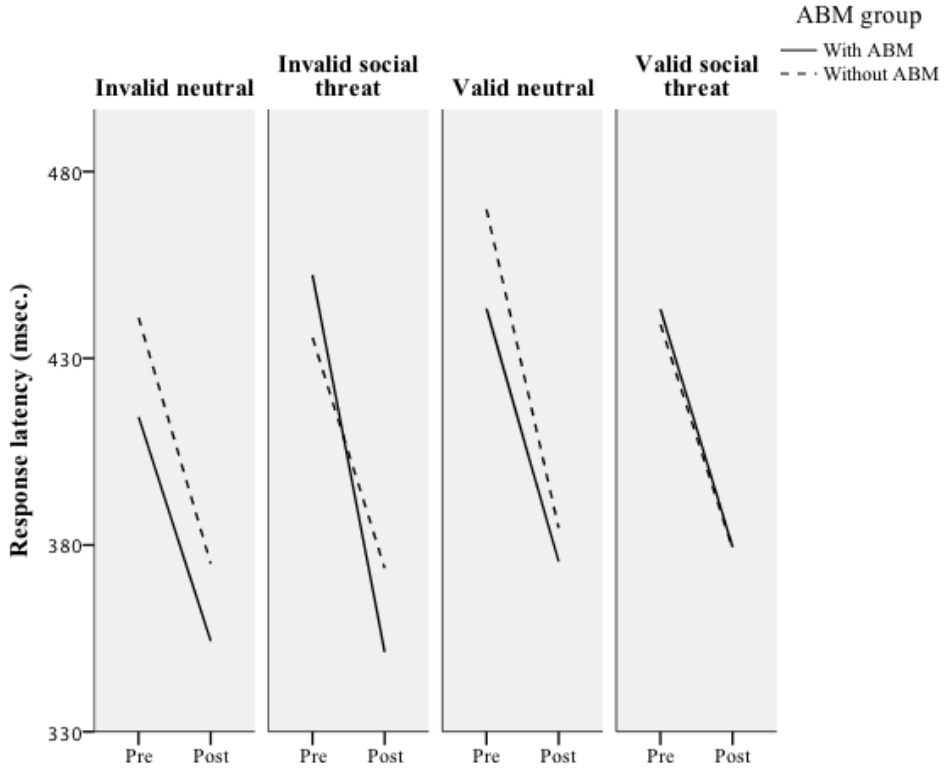

Figure 2. *Response latencies on the modified Posner task pre- and post-assessment*

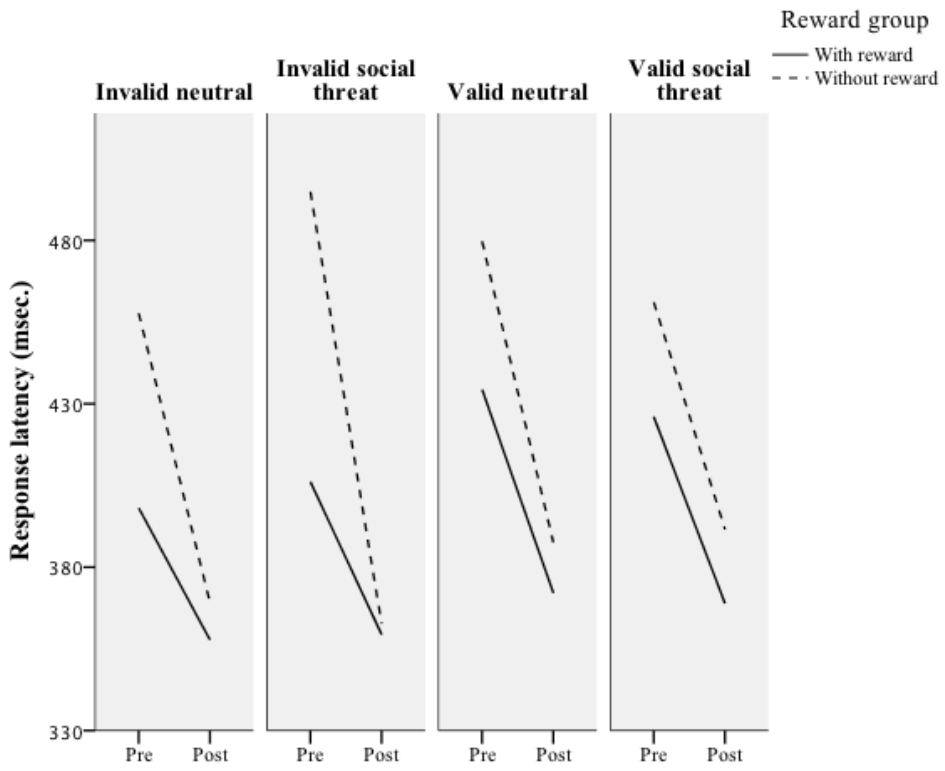

Figure 3. *Response latencies on the modified Posner task pre- to post-assessment*

Results also revealed a significant 2 (Trial value: invalid, valid) × 2 (Cue word type: social threat, neutral) × 2 (Time: pre-assessment, post-assessment) × 2 (Reward: reward, no reward) interaction, $F(1, 23) = 6.55$, $p = 0.18$, $\eta^2_p = 0.22$. To follow up this four-way interaction, a separate Reward × Time × Trial value ANOVA for social threat and neutral words, was conducted. For social treat words, this analysis revealed a main effect of Time $F(1, 25) = 29.1$, $p = .000$, $\eta^2_p = .54$, and Trial value, $F(1, 25) = 8.43$, $p = .008$, $\eta^2_p = .25$. The main effect of Reward, was not significant, $F(1, 25) = .57$, $p = .46$, $\eta^2_p = .0.22$. The Reward × Time × Trial value interaction was not significant.

For neutral words, there was a main effect of Time $F(1, 25) = 26.9$, $p = .000$, $\eta^2_p = .52$, and Trial value, $F(1, 25) = 11.9$, $p = .002$, $\eta^2_p = .32$, which was modified a by Time × Trial value interaction, $F(1, 25) = 5.86$, $p = .023$. $\eta^2_p = .19$. Examination of the means suggest that all participants became faster in responding to neutral valid trials than neutral invalid trials, from

pre- to post assessment. The reward × Time × Trial value interaction was not significant, $F(1.25) = 3.63$, $p = .68$, $\eta^2_p = .13$.

Effects of ABM and reward on self-report measures of social anxiety

Table 2 presents the baseline and post-treatment mean outcome scores on the four social phobia (SP) self-report measures for each condition as well as standard deviations and effect sizes. Repeated measures ANOVAs were carried out on each SP measure with ABM group and Reward group as the between-subjects factor.

Table 2. *Means and standard deviations for Self-report scales measures by conditions, pre- and post- treatment*

		ABM without reward		ABM with reward		Control with reward		Control without reward	
		M (*SD*)	*d*	*M* (*SD*)	*d*	*M* (*SD*)	*d*	*M* (*SD*)	*d*
SPAI	Pre	117(14)		114(26)		124(21)		115(16)	
	Post	96(24)	1.07	102(27)	0.45	105(25)	0.82	115(15)	0.0
SIAS	Pre	59(9)		51(16)		51(8)		51(14)	
	Post	48(9)	1.22	46(17)	0.93	42(12)	0.88	44(13)	0.52
SPS	Pre	38(20)		32(13)		31(13)		40(12)	
	Post	25(11)	0.81	22(9)	0.89	22(9)	0.80	28(9)	1.13
LSAS	Pre	86(15)		75(29)		76(32)		74(22)	
	Post	70(8)	1.33	66(28)	0.32	65(29)	0.18	63(21)	0.51

Note: d= Cohen's *d*, based on pre-and post-treatment change within conditions.

The results for SPAI revealed a main effect of Time, $F(1, 23) = 14.14$, $p = .001$, $\eta^2_p = .38$, as scores tended to be lower post-treatment then pre-treatment. Figure 4 shows mean score reduction on SPAI scores by ABM and Reward groups. The main effect of ABM group

was not significant, $F(1, 23) = .77$, $p = .39$, $\eta^2_p = .03$, as scores on SPAI did not differ between participants who received ABM and those who did not. The main effect of Reward was also not significant, $F(1, 23) = .03$, $p = .88$, $\eta^2_p = .001$ suggesting that SPAI scores did not differ between participants who received, or did not receive, reward. There was a significant Time × Reward × ABM interaction, $F(1, 23) = 4.7$, $p = .41$, $\eta^2_p = 0.17$, but Time × ABM, $F(1, 23) = 1.89$, $p = .18$, $\eta^2_p = .076$, Time × Reward, $F(1, 23) = .75$, $p = .40$, $\eta^2_p = .32$, and Reward × ABM, $F(1, 23) = .001$, $p = .98$, $\eta^2_p = .000$, interactions were not significant.

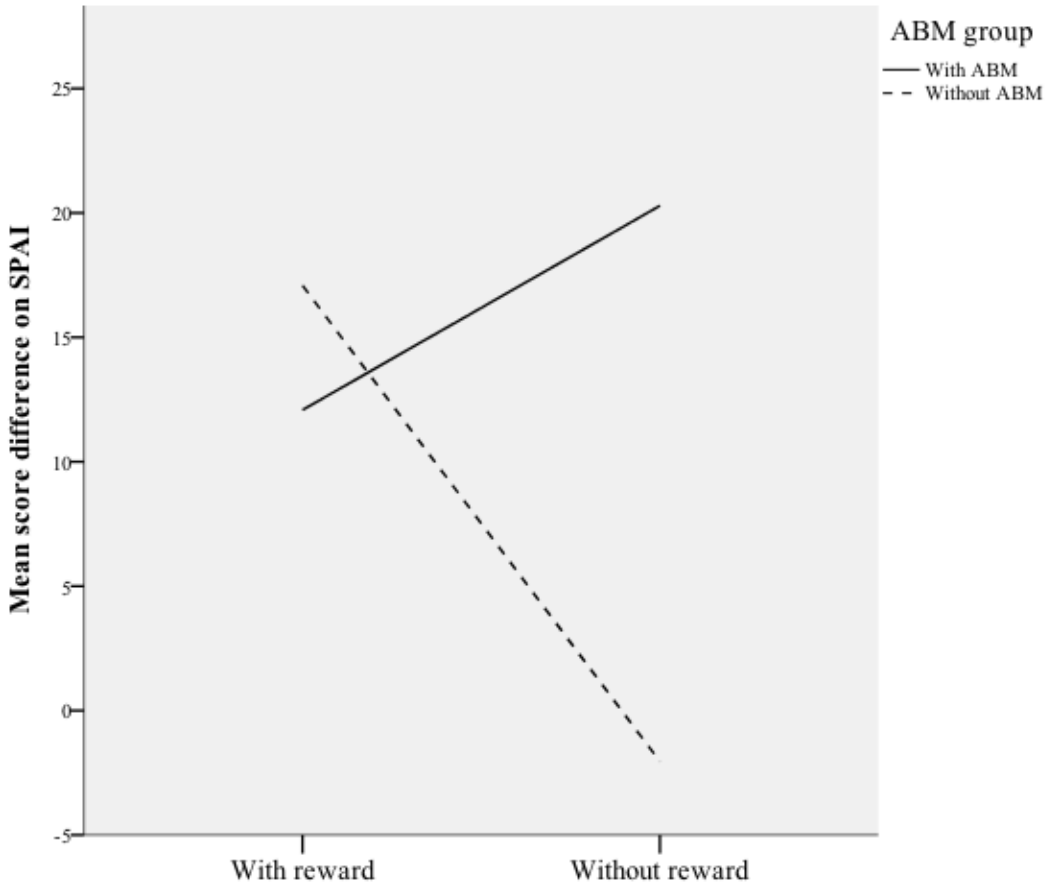

Figure 4. *Mean score difference on the SPAI scale*

The SIAS scores revealed a significant main effect of Time, $F(1, 23) = 17.69$, $p < .001$, $\eta^2_p = .44$, as scores tended to be lower after treatment then before treatment on the SIAS scale. Figure 5 shows mean score reduction on SIAS scores by ABM and Reward groups. The main

effects of ABM group, $F(1, 23) = .77$, $p = .39$, $\eta^2_p = .032$, and Reward, $F(1, 23) = .24$, $p = .63$, $\eta^2_p = .01$, were not significant. There were no significant Time × ABM, $F(1, 23) = 0.56$, $p = .46$, $\eta^2_p = .02$, Time × Reward, $F(1, 23) = .56$, $p = .90$, $\eta^2_p = .001$, or AMB × Reward, $F(1, 23) = .313$, $p = .58$, $\eta^2_p = .13$, interactions.

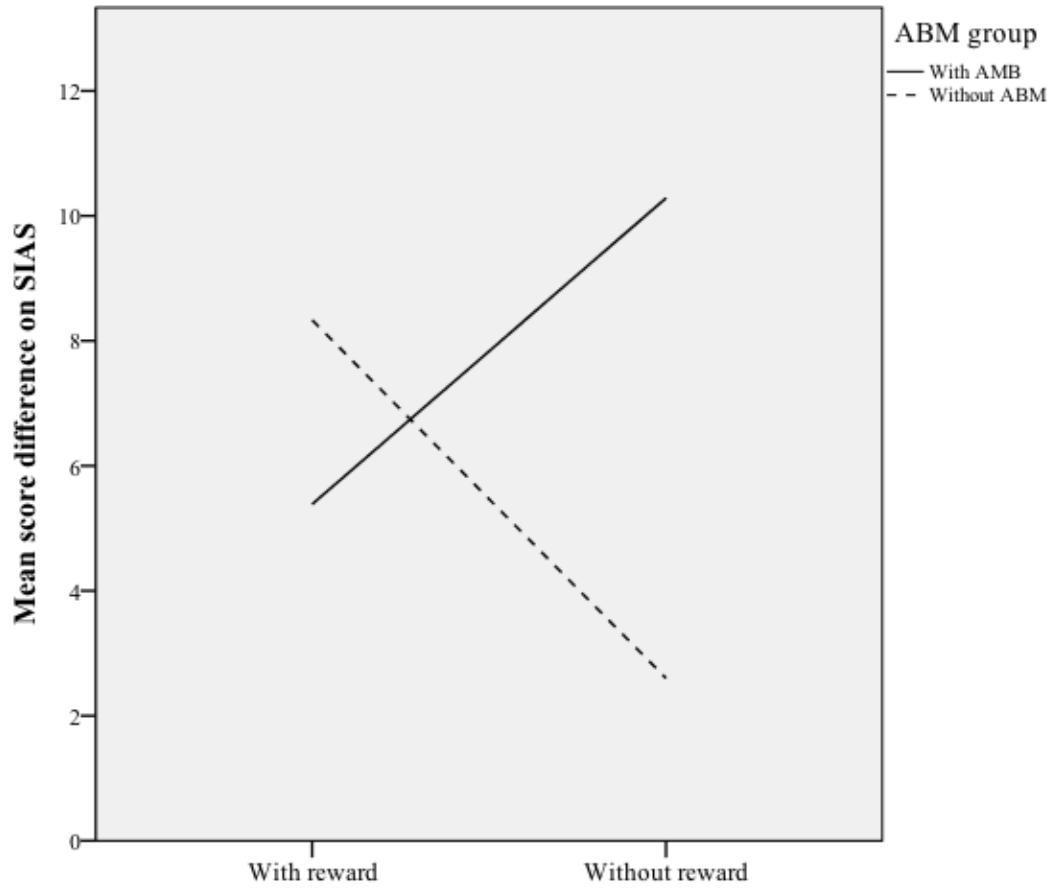

Figure 5. *Mean score difference on the SIAS scale*

On the SPS there was a significant main effect of time, $F(1, 23) = 17.7$, $p < .001$, $\eta^2_p = .44$, as scores tended to be lower post-treatment then pre-treatment. Figure 6 shows mean score reduction on SPS scores by ABM and Reward groups. The main effect of ABM was not significant, $F(1, 23) = .052$, $p = .82$, $\eta^2_p = .002$ suggesting that SPS scores did not differ between conditions or between participants who received AMB and those who did not. There

was also no significant main effect of reward, $F(1, 23) = 1.02$, $p = .32$, $\eta^2_p = .04$, as scores on SPS did not differ between participants receiving reward and those who did not receive reward. There were no significant time × ABM, $F(1, 23) = 0.29$, $p = .60$, $\eta^2_p = .01$, or time × reward interactions, $F(1, 23) = .45$, $p = .51$, $\eta^2_p = .01$.

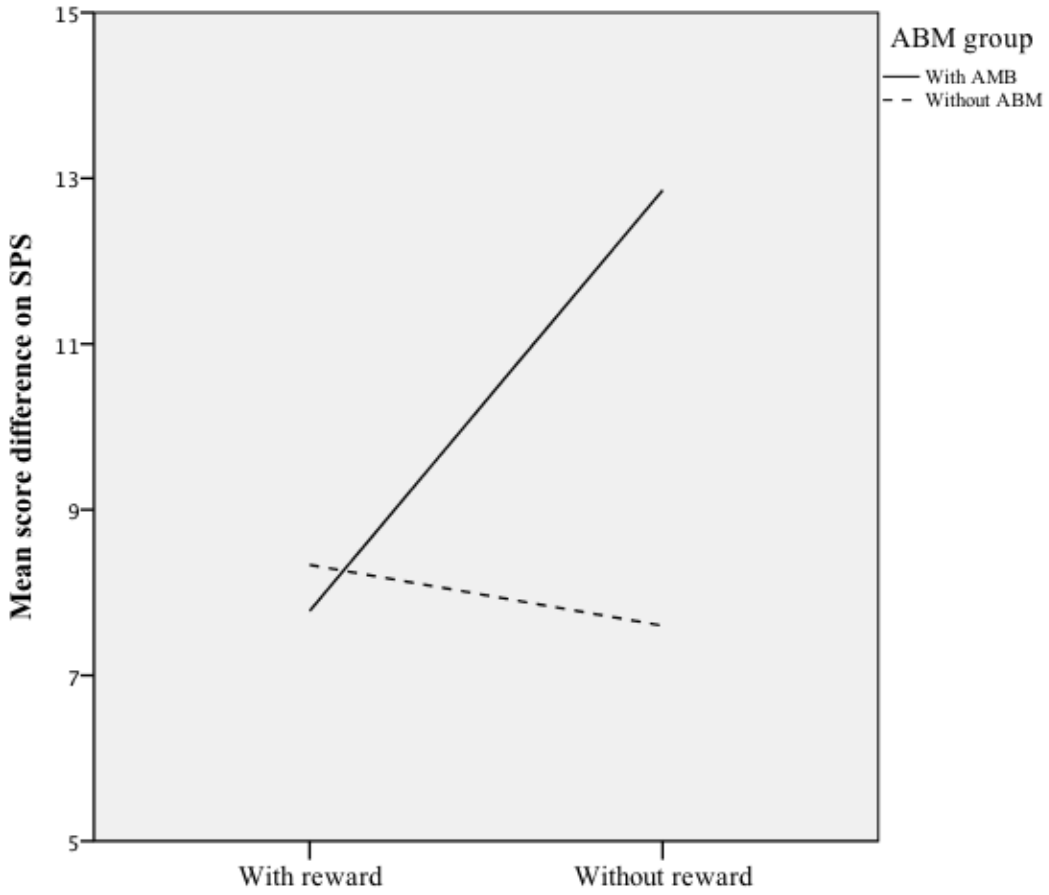

Figure 6. *Mean score difference on the SPS scale*

Lastly, on the LSAS there was a significant main effect of time, $F(1, 23) = 15.9$, $p = .001$, $\eta^2_p = .41$, as scores tended to be lower post-treatment then pre-treatment. Figure 7 shows mean score reduction on LSAS scores by ABM and Reward groups. There was not a significant main effect of either ABM, $F(1, 23) = .29$, $p = .60$, $\eta^2_p = .01$, or reward, $F(1, 23) =$

.096, p = .76, η^2_p < .01. There were also no significant time × ABM, $F(1, 23) = 0.62$, p=.44, η^2_p = .03, or time × reward, $F(1, 23) = .03$, p = .87, η^2_p <.01, interactions.

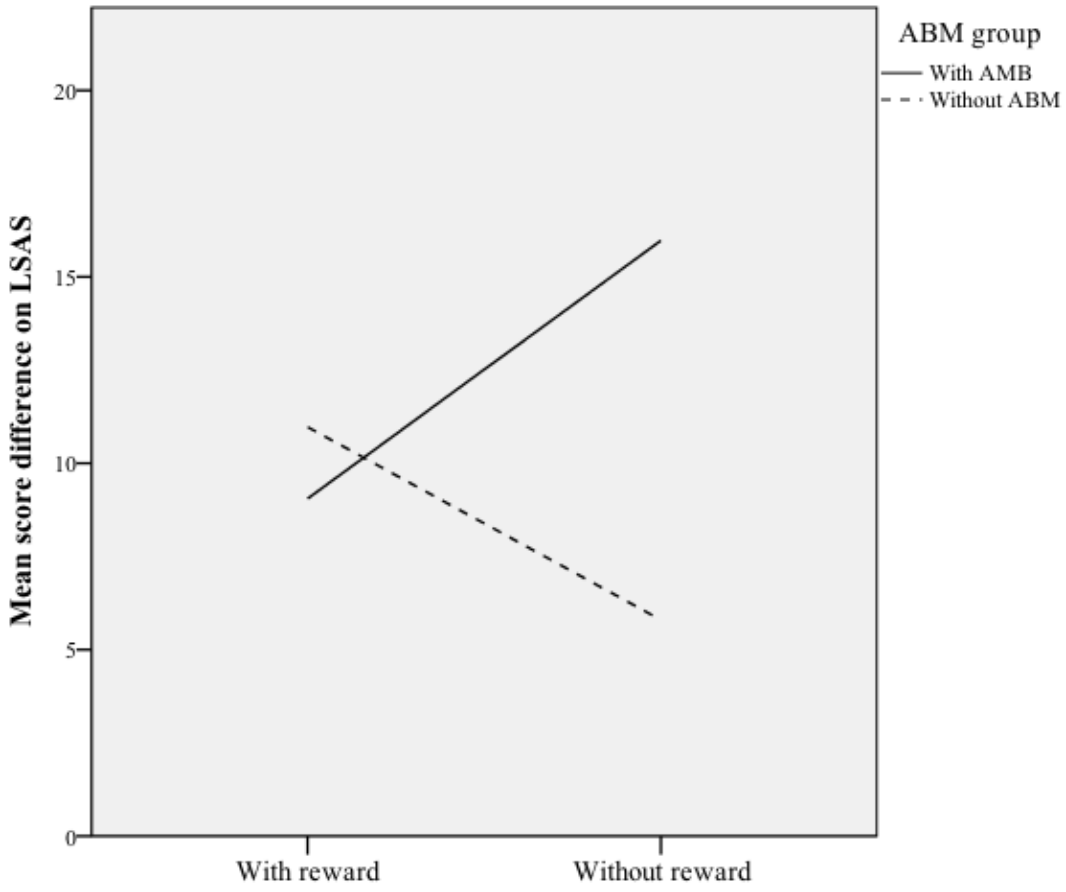

Figure 7. *Mean score difference on the LSAS scale*

Discussion

The main purpose of this study was to test the efficacy of integrating attentional bias modification techniques and rewards with standard cognitive behavior group therapy for social anxiety disorder patients.

The first hypothesis was that attentional bias modification with CBGT would be more effective with regard to SAD symptoms and attentional biases (AB) towards threatening stimuli than CBGT alone. Results did not support the hypothesis. We were not able to show

that adding ABM to CBGT resulted in additional benefits, as there were no significant reductions in AB towards threat or symptoms of anxiety, beyond control.

These results are in line with Rapee et.al (2013), who also did not find a significant effect. There was no significant main effect of cue type, trial validation, conditions, ABM or reward on response latency suggesting that participants who received ABM training with CBGT were equally as successful in disengaging from threatening stimuli as those who received only CBGT (control).

Considering recent meta-analysis in the field of anxiety disorders, which establish the promising effects of ABM (Hakamata et al. 2010; Hallion & Ruscio, 2011), these findings were somewhat unexpected. There was a reduction in AB from pre- to post-assessment but differences between those who received ABM in addition to CBGT and those who did not receive ABM were not significant. Reduction in AB towards threat has been revealed due to cognitive behavioral therapy alone (Tobon, Ouimet & Dozois, 2011). Therefore a possible reason for this outcome may be that ceiling effects surfaced that limited further effects of ABM, or that the Posner task used for measuring AB, was not sensitive enough to measure the, perhaps small change in bias. Participants received 8 to 16 ABM sessions, 20 to 30 minutes each, which is a varying amount of time exposed to the modification program between participants. There is no known minimal exposure needed for producing attentional changes, but perhaps more sessions would have been required. It would be interesting to study the effects of variable amounts of ABM sessions on AB and symptoms of anxiety to examine the effects of different number of sessions. It would then perhaps be possible to find out how many sessions are sufficient for modifying AB. Since ABM did not reduce AB beyond CBGT, it is, perhaps, not surprising that effects on symptoms of SAD were not influenced by it either.

The second hypothesis stated that providing higher reward for neutral than threatening faces to CBGT is more effective with regard to SAD symptoms and attentional biases towards threatening stimuli than CBGT alone (control condition). This was not supported, as there was no difference in response latency between any conditions. There was also no difference between either those who received ABM or those who did not, or between those who received higher reward for neutral faces than threatening and those who did not. Adding reward manipulation to CBGT did thus not reveal any additional benefits in reducing attentional bias and anxiety disorder symptoms.

As with participants in ABM groups, there was a reduction in AB from pre- to post assessment for patients in reward groups, even though no significant differences between the groups or conditions were found. The reason for these reductions in AB are likely because of the effects CBGT has on AB (Tobon, Ouimer & Dozois, 2011), and possibly the effects of reward were too insignificant to be detected.

The non-significant results may also reflect limited power since the participants were relatively few. Also, the time since participants completed CBGT varied between conditions, which could have influenced results. In the sample the proportion of males versus females was unequal, which may explain why there were significant gender differences between reward groups, since 12 females received reward, but only 3 males. No follow-up assessments were conducted.

In light of the small sample size, it is important to replicate the study with a larger sample, and to add follow-up assessments. In addition it would be worth exploring whether the combination of ABM and CBGT would be more effective if ABM were carried out before, or even after, CBGT. Reduced attentional biases due to ABM could perhaps make the behavioral experiments in CBGT more effective and conducting ABM after CBGT might also help with maintaining treatment gains. In the current study, pictures were used as stimuli in

the ABM task, but research indicates that verbal stimuli may work better in reducing AB (see meta-analysis Hakamata et al., 2010). That information should be used in future investigations.

Despite non-significant differences between conditions, ABM group and reward group, there was a significant interaction between reward, trial value, cue type and time for response latency. Response time tended to be shorter for threatening cue words than for neutral cue words, which indicates AB, as well as being shorter on invalid trials than on valid trials, which indicates facilitated engagement. Comparing pre- and post-assessments, a larger reduction in RT was found on invalid, versus valid trials and participants also started to respond faster to neutral valid trials, than neutral invalid trials from pre- to post-assessment. In general, RT was shorter from pre- to post assessment. These findings indicate that participants had an attentional bias towards threat. The reason why RTs were shorter from pre- to post-assessment could be due to the training participants had in visual search tasks through the modification period.

In summary, our results did not indicate that ABM, reward manipulation, or the combination of the two added anything to the CBGT as a treatment for SAD patients. Despite that fact, treatment proved successful. Analyses on the SP scales revealed a significant main effect of time as participants showed score reductions on all SP scales from pre- to post assessment. Although this current study did not show additional effects of ABM and reward manipulation on symptoms of SAD and AB beyond CBGT, it does not necessarily mean that adding ABM or reward to CBGT is always unsuccessful. It does however suggest that further research on these processes is needed for a better understanding on how they operate. This can hopefully reveal ways of finding the most successful treatment for SAD.

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