

The Effects of a Brief Acceptance-Based Behavioral Treatment Versus Traditional Cognitive-Behavioral Treatment for Public Speaking Anxiety: An Exploratory Trial Examining Differential Effects on Performance and Neurophysiology

Behavior Modification

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Abstract

Individuals with public speaking anxiety (PSA) experience fear and avoidance that can cause extreme distress, impaired speaking performance, and associated problems in psychosocial functioning. Most extant interventions for PSA emphasize anxiety reduction rather than enhancing behavioral performance. We compared the efficacy of two brief cognitive-behavioral interventions, a traditional cognitive-behavior treatment (tCBT) and an acceptance-based

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behavior treatment (ABBT), on public speaking performance and anxiety in a clinical sample of persons with PSA. The effects of treatment on prefrontal brain activation were also examined. Participants ($n = 21$) were randomized to 90 min of an ABBT or a tCBT intervention. Assessments took place at pre- and post-treatment and included self-rated anxiety and observer-rated performance measures, a behavioral assessment, and prefrontal cortical activity measurements using functional near-infrared spectroscopy (fNIRS). Exploratory results indicated that participants in the ABBT condition experienced greater improvements in observer-rated performance relative to those in the tCBT condition, while those in the tCBT condition experienced greater reductions in subjective anxiety levels. Individuals in the ABBT condition also exhibited a trend toward greater treatment-related reductions in blood volume in the left dorsolateral prefrontal cortex relative to those who received tCBT. Overall, these findings preliminarily suggest that acceptance-based treatments may free more cognitive resources in comparison with tCBT, possibly resulting in greater improvements in objectively rated behavioral performances for ABBT interventions.

Keywords

anxiety/anxiety disorders, brain imaging/neuroimaging, SAD/social anxiety disorder/social phobia, ACT/acceptance and commitment therapy, CBT/cognitive-behavior therapy

Introduction

Although feeling anxious while speaking in public is a normal occurrence (Stein, Walker, & Forde, 1996), 33% of the population experience severe and incapacitating anxiety in these situations and qualify for a diagnosis of the specific (i.e., non-generalized) subtype of social anxiety disorder (SAD, also referred to as social phobia; Grant et al., 2005). In addition to debilitating speech-related anxiety, there is evidence that individuals with public speaking anxiety (PSA) experience impaired speech performance, which affects their social, occupational, and educational functioning (Daly, 1978; Hofmann, Gerlach, Wender, & Roth, 1997; Lewin, McNeil, & Lipson, 1996; Stein, Torgrud, & Walker, 2000). These research findings have led to the inclusion of a performance-only specifier for SAD in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013). Although individuals do not accurately assess their own social performance (Carrell & Willmington, 1996; Leserman & Koch,

1993), the majority of speech performance data have been collected using self-report measures. The limited observer-rated data that do exist provide preliminary evidence of noteworthy speech performance impairments among those with PSA. Compared with controls, participants with PSA exhibit poorer observer-rated speech performance, including significantly reduced eye contact, more frequent and longer pauses, and excessive use of speech fillers (i.e., “ah”-like utterances; Hofmann & Roth, 1996; Lewin et al., 1996).

To date, the impact of current treatments on public speaking performance has received minimal attention. Moreover, as noted above, most studies that have examined behavioral performance have relied on self-ratings. It is important to determine which treatments are most effective not only in addressing anxiety but also in improving performance.

Current Interventions for PSA

Current PSA interventions generally employ cognitive-behavioral therapy (CBT) techniques that focus on reducing anxiety through (a) modifying (i.e., “restructuring”) cognitions (e.g., negative thoughts and associated beliefs about one’s ability to perform) that are believed to generate social performance anxiety and (b) exposure to the feared situation to facilitate such cognitive changes and to encourage participation in desired behaviors, which are also thought to mediate habituation of anxiety (Heimberg & Becker, 2002). A large randomized controlled trial of cognitive-behavioral group therapy (CBGT; Heimberg, 1991) reported that 75% of CBGT completers with mixed forms of SAD experienced significant reductions in anxiety (Heimberg et al., 1998). Other studies have replicated these results (Heimberg et al., 1998; Heimberg, Salzman, Holt, & Blendell, 1993; Herbert et al., 2005; Liebowitz et al., 1999). A few studies also have reported that CBGT produced observer-rated social performance gains at post-treatment and at 6-month follow-up, again in samples of generalized or of mixed types of SAD (Heimberg, Hope, Dodge, & Becker, 1990; Heimberg et al., 1993; Herbert et al., 2005). A cognitively based intervention for SAD (D. M. Clark & Wells, 1995) produced especially strong results, in comparison with waitlist control, medication (e.g., fluoxetine), and CBGT for social phobia (Clark et al., 2003; Stangier, Heidenreich, Peitz, Lauterbach, & Clark, 2003).

Cluster analyses on SAD have identified performance anxiety as a distinct subtype of SAD (Eng, Heimberg, Coles, Schneier, & Liebowitz, 2000; Furmark, Tillfors, Stattin, Ekselius, & Fredrikson, 2000). Therefore, research on performance enhancement following a CBT-focused treatment that incorporated mixed samples or generalized SAD-only samples may not be directly

applicable to individuals with PSA. Of note, there have been no studies on performance outcomes in PSA-only samples following CBT intervention.

The CBT interventions summarized above share the traditional Beckian focus on identifying and modifying maladaptive cognitions that are understood to create and maintain anxious reactions. Whereas traditional CBT (tCBT) is, as a whole, successful in reducing social anxiety, there are questions about the specific efficacy of its cognitive components. For example, most component-control studies examining tCBT for SAD have found no difference in treatment outcome between exposure therapy alone and exposure with a cognitive restructuring component (Hofmann, 2004; Salaberria & Echeburua, 1998; Scholing & Emmelkamp, 1996), suggesting that tCBT's cognitive component may not accrue incremental effects to exposure alone. In fact, strategies that aim to control anxiety (including cognitive restructuring) may tax cognitive resources, and thus, it is theoretically possible that they could reduce an individual's ability to maximally perform at other tasks, such as giving a speech (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Taken together, these findings call into question whether tCBT would be maximally effective for treatment for PSA.

Over the past decade, there has been an increased focus on CBT models that highlight acceptance and mindfulness components (Herbert & Forman, 2011; Herbert, Forman, & England, 2009). The most researched of this new acceptance-based behavioral treatment (ABBT) is acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999, 2011), and this treatment has been applied to various anxiety disorders including SAD (Dalrymple & Herbert, 2007), post-traumatic stress disorder (PTSD; Orsillo & Batten, 2005), and generalized anxiety disorder (Roemer, Orsillo, & Salters-Pedneault, 2008). ACT is a newer model of CBT that does not emphasize anxiety reduction or the alteration of anxiety-provoking cognitions. ACT also targets engagement in desired behaviors, and individuals are encouraged to participate in these activities while mindfully accepting distressing thoughts and sensations (Hayes et al., 1999). Exposure techniques are framed as opportunities to help the patient experience anxiety as less threatening and to diminish the relationship between distressing thoughts and behavior. Patients are taught to focus their attention on engaging in valued behaviors (e.g., speaking up in public) rather than cognitive or emotional control.

Only a few studies have investigated ACT in PSA. Block (2003) recruited a small sample of undergraduates who feared public speaking ($n = 39$) and compared ACT group therapy, (traditional) CBGT, and waitlist controls over 4 weeks. In a measure of behavioral avoidance given at pre- and post-treatment, participants were asked give a short speech and to remain in front of a group for as long as possible. Compared with those who had received CBGT,

those who received ACT demonstrated significantly greater endurance (and thus reduced avoidance) at post-treatment when compared with pre-treatment performance. England et al. (2012) randomized participants with PSA to receive either group exposure therapy that was presented with a traditional habituation-based rationale or a group exposure treatment with an acceptance-based rationale. At the conclusion of the 6-week intervention, the two treatment groups demonstrated equivalent reductions in anxiety and improvements in performance, although the acceptance group demonstrated significantly greater rates of diagnostic remission by 6-week follow-up.

Larger studies have examined the impact of acceptance-based treatment on SAD, which often include participants with PSA. Craske and colleagues (2014) compared a waitlist control group with 12 individual sessions of CBT or ACT for individuals with Social Phobia. The authors found that both treatments did better than the waitlist control group but did not find differences in outcomes between CBT and ACT at post-treatment or at 12-month follow-up (Craske et al., 2014). Similarly, Kocovski, Fleming, Hawley, Huta, and Antony (2013) compared mindfulness- and acceptance-based group therapy (MAGT), CBGT, and a waitlist control group. There were no differences in outcome between MAGT and CBGT, but both were more effective than the control group (Kocovski et al., 2013). These studies suggest that both ACT and CBT are effective, comparable treatments for social phobia; however, neither study separated out results for a PSA-only sample.

Brain Activation and PSA

A better understanding of the neural substrates of PSA may help to explain why certain individuals respond to treatment, whereas others do not. Whereas both the prefrontal cortex (PFC) and the limbic system are known to be implicated in the maintenance of anxiety disorders (Davidson, 2002; Etkin & Wager, 2007; Freitas-Ferrari et al., 2010), no studies to date have investigated the neural basis of PSA specifically, and only a few studies have examined the PFC in generalized SAD. Studies using either positron emission tomography (PET), electroencephalography (EEG), or repetitive transcranial magnetic stimulation (rTMS) in generalized SAD samples have reported mixed results. While some studies report that individuals who were anticipating a public speaking task experienced an increase in cerebral blood flow in the right dorsolateral prefrontal cortex (DLPFC), regions within the temporal cortex, and the amygdala in comparison with healthy controls (Davidson, Marshall, Tomarken, & Henriques, 2000; Sachs, Anderer, Dantendorfer, & Saletu, 2004; Tillfors, Furmark, Marteinsdottir, & Fredrikson, 2002), other studies have reported decreases in right frontal

regions (Lorberbaum et al., 2004).. Although hemispheric asymmetry appears to be prominent in anxiety disorders, there is not yet enough evidence to draw reliable conclusions. Although this research has been important in our understanding of generalized SAD, findings cannot be directly generalized to individuals with PSA. In addition, the physical restrictions imposed by many conventional neuroimaging modalities (e.g., PET, functional magnetic resonance imaging [fMRI]) limit the ecological validity of the tasks that can be employed to understand the neural underpinnings of PSA (e.g., giving a public speech; Tuscan et al., 2013).

Some studies have investigated changes in brain activation following cognitive-behavioral treatments for anxiety disorders. Data from a small number of studies show changes in regional brain oxygenation following computed tomography (CT) in panic disorder (Prasko et al., 2004), specific phobia (Paquette et al., 2003), and obsessive-compulsive disorder (OCD; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996). Paquette et al. (2003) used fMRI to investigate neural changes before and after CT treatment for spider phobia. After treatment, participants did not experience over-stimulation in the DLPFC or the parahippocampal gyrus, during spider exposures (both these regions were very active during exposures given prior to treatment). Goldin, Manber, Hakimi, Canli, and Gross (2009) also found reduced activation in the DLPFC and the dorsal anterior cingulate cortex when individuals with SAD attempted to cognitively reappraise their response to social threat.

Preliminary research supports the continued investigation of distinctive neural correlates of cognitive-behavioral therapies. Identifying changes in neural mechanisms between tCBT and ABBTs would have significant implications for understanding anxiety and its impact on performance, as well as the mechanisms by which the two interventions exert their effects.

Current Study

This study compared the relative efficacy of ABBT and tCBT in a clinical sample of individuals with PSA, and secondarily examined the neurophysiological changes associated with each treatment using functional near-infrared spectroscopy (fNIRS). fNIRS is an emerging neuroimaging technology that can be deployed as a lightweight and wearable probe that permits ambulatory monitoring of brain activity during real-world performance situations. This technology has been shown to be both reliable and valid in several fMRI replication studies across several cognitive tasks (Cui, Bray, Bryant, Glover, & Reiss, 2011; Kennan, Kim, Maki, Koizumi, & Constable, 2002; Toronov et al., 2001). As both ABBT and tCBT have demonstrated efficacy in anxious populations, we hypothesized that all participants would experience a

reduction in anxiety and improvement in performance regardless of condition. Although tCBT is the gold standard treatment for social anxiety and has a large number of empirical studies supporting its efficacy, we hypothesized that an ABBT-based treatment would be more effective at improving speech *performance* because it may be less cognitively demanding. Given research suggesting that ABBT and tCBT may operate, at least in part, via distinct mechanisms (Forman et al., 2012), we also sought to explore differences between the treatments in PFC activity, anticipating that activation levels would decline in both treatments with greater decreases in the ABBT condition across hemispheres.

Materials and Method

Participants

Eighty-seven individuals were preliminary assessed for inclusion into the study. Sixty-six of these individuals were excluded because they did not meet study inclusion or exclusion criteria. To be eligible for participation, individuals had to be between ages 18 and 50, currently living in the greater Philadelphia area, deemed to have a primary diagnosis of SAD with PSA as the only clinically significant fear, right-handed, and have English as their first and dominant language (there is evidence of differences in brain activation during language-related tasks for bilingual individuals; see Abutalebi, Cappa, & Perani, 2001, for more information). Main exclusion criteria included generalized SAD (11 excluded), non-primary SAD (one excluded), bilingual (16 excluded), left-handedness or ambidexterity (six excluded), history of neurological abnormalities (e.g., stroke, seizures, heart disease, migraines; four excluded), history of or current severe psychiatric illness (none excluded), unstable or serious medical illness (none excluded), history of substance dependence or current diagnosis of any substance dependence (one excluded), current depressed mood or acute suicide potential (none excluded), certain medications (e.g., psychotropic medication, blood pressure medications, “pain killers,” investigational medications, any medication use associated with central nervous system effects; five excluded), intellectual disability or any other pervasive developmental disorder (none excluded), or uninterested in participation (six excluded).

Twenty-one individuals meeting criteria for the public speaking subtype of SAD and other study criteria provided informed consent to participate in this research study and received compensation for their participation. No participants were receiving psychotherapy, taking medications, met criteria for substance abuse or dependence, or met *Diagnostic and Statistical Manual of*

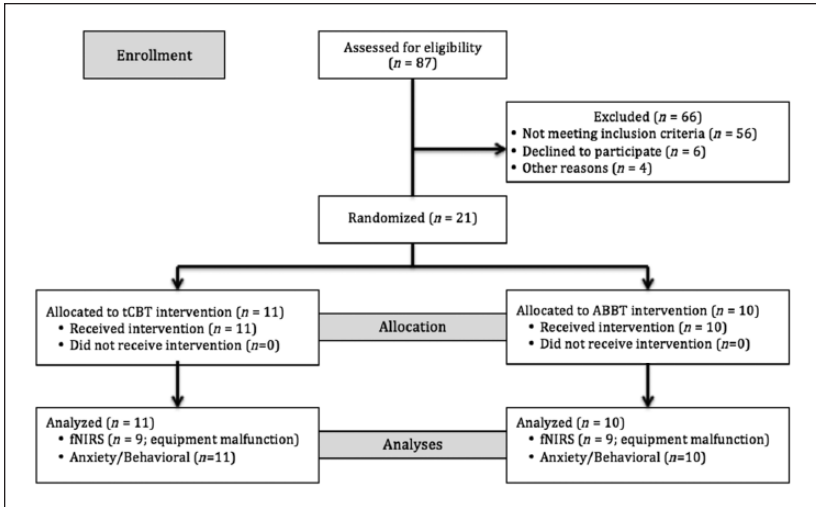


Figure 1. CONSORT diagram.

Note. tCBT = traditional cognitive-behavior treatment; ABBT = acceptance-based behavior treatment; fNIRS = functional near-infrared spectroscopy.

Mental Disorders (4th ed., text rev.; *DSM-IV-TR*; APA, 2000) criteria for another current anxiety or mood disorder other than PSA. Participants ranged in age from 18 to 49 years ($M = 28.10$, $SD = 9.30$). The majority were female (76%) and White (66%), with the remainder self-identifying as African American (29%) and Asian American (5%; see CONSORT diagram, Figure 1). All participants were right-handed. Participants were recruited through university fliers and advertisements, Craigslist, and online forums. Study announcements advertised 90-min anxiety-management sessions and two study assessments over 3 hr, and mentioned that individuals could be compensated up to US\$50 for completed participation.

Measures

Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV). The social phobia and depression portions of the ADIS-IV (Brown, Di Nardo, & Barlow, 1994), which were given by the study therapists at the beginning of the study session to establish participant eligibility, comprise part of this widely used diagnostic interview that assesses a variety of anxiety and mood disorders using *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; APA, 1994) criteria. Inter-rater reliability for diagnosing SAD using the

ADIS-IV is high (Brown, Di Nardo, Lehman, & Campbell, 2001). The ADIS also distinguishes generalized SAD from public speaking phobia and has exhibited good reliability in the assessment of SAD ($\kappa = 0.77$; Brown et al., 2001).

Structured Clinical Interview for DSM-IV (SCID-IV) Axis I Disorders—SAD subsection. The diagnosis of SAD was also confirmed by study therapists via the SAD subsection of the SCID-IV Axis I Disorders (First, Spitzer, Gibbon, & Williams, 1996). The SCID-IV is an extensively utilized structured diagnostic interview based on *DSM-IV* (APA, 1994) criteria. Estimates of inter-rater reliability and test–retest agreement are moderate to high for SAD (Zanarini et al., 2000).

Subjective Units of Discomfort Scale (SUDS). Participants were instructed how to rate their subjective intensity of anxiety using the SUDS, which is a self-rating scale that ranges from 0 to 100 (Wolpe & Lazarus, 1966). SUDS ratings were obtained throughout the study procedures and primary task conditions and served as the primary self-rated measure of anxiety.

Behavioral Assessment Test (BAT). The BAT (see D. B. Clark et al., 1997, for a brief review) consisted of three parts: a date-naming control task, an impromptu speech before a small virtual audience, and another date-naming control task after the speech. The two control tasks (pre- and post-impromptu speech) were utilized to measure brain activation while the participant was talking and standing, but not engaging in the public speaking task. These pre- and post-speech control tasks were identical and lasted for 30 s each. Brief baseline periods and periods of task performance have been used as control tasks in a variety of fNIRS methodologies (Banaji, Mallet, Elwell, Nicholls, & Cooper, 2008; Hyde, Boas, Blair, & Carey, 2010; Wijekumar, Shahani, Simpson, & McCulloch, 2012). For our two control tasks, the experimenter asked the participants to list a series of random dates of the year out loud. They were told that the dates they picked were not important, but that they just needed to speak as much as possible. This rationale was given to reduce the amount of anxiety and social pressure that the individual experienced during these tasks. This method appeared to be effective, as participants rated their self-consciousness during the control tasks as a 3.4/10 (“very little,” $SD = 2.55$). The speech task consisted of a 4-min speech in front of an 8-person audience displayed on a 24-inch TV monitor. Although the audience was pre-recorded, participants were told that the group was sitting in a nearby conference room and the video was a live-feed. A virtual audience was chosen to ensure standardization in gender, nonverbal cues, and number of audience members

across participants. Virtual audiences have been successfully used to elicit anxiety during social tasks in other research studies (Anderson, Rothbaum, & Hodges, 2003; Klinger et al., 2005; Powers & Emmelkamp, 2008). The pre-recorded audience members were asked to remain as neutral as possible, and to avoid any facial and body movements. Participants were instructed to speak until instructed to stop by the experimenter (they were not told that the task would last for 4 min). The entire speech was video recorded to allow masked study assessors to rate performance using the Speech Performance Scale (SPS). Participants reported that the audience felt moderately to very real on a 1 to 10 scale ($M = 6.84/10$; $SD = 2.80$) after participation in the study but before debriefing; there were no differences between groups.

SPS. The video recorded BAT was evaluated for performance by independent observers using the SPS (Rapee & Lim, 1992). Raters, masked to condition and assessment occasion, rated each participant's performance using this 17-item measure. The SPS evaluates both specific (e.g., kept eye contact with audience, "Um'ed" and "Ah'ed") and global (e.g., kept audience interested, generally spoke well) elements. Each item was rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*very much*), with higher scores signifying better performance. Some items were reversed to avoid response biases. This scale has been shown to have good internal consistency ($r = .84$; Rapee & Lim, 1992). A primary rater evaluated all of the recordings and second assessor rated 30% (chosen at random) for reliability purposes. The intraclass correlation coefficient between the two observers was .79 (95% confidence interval [CI] = [.76, .95], $p < .01$).

fNIRS instrumentation. The fNIRS device used in this study was a continuous-wave system that provided a non-invasive and portable measurement of changes in cerebral blood oxygenation and total blood volume while participants engaged in the public speaking task. We used a 16-channel fNIRS system described by Izzetoglu et al. (2005) that uses a flexible sensor spanning the PFC (also see Glassman et al., 2014, for a detailed description of this device). fNIRS technology has demonstrated preliminary validity among those with panic disorder (Akiyoshi, Hieda, Aoki, & Nagayama, 2003), phobias (Kochel et al., 2011), PTSD (Matsuo et al., 2003), and in undergraduates with varying levels of social anxiety (Tuscan et al., 2013). This technology measures changes in functional hemodynamic activity by measuring the rate at which near-infrared light is absorbed in cortical tissue at two different wavelengths, yielding indices that reflect the relative concentration changes of oxygenated and deoxygenated hemoglobin (Villringer & Chance, 1997). Research has indicated that fNIRS indices of hemodynamic activity correlate

in an expected pattern with the blood-oxygen level dependent signal of fMRI across various cognitive tasks (Cui et al., 2011; Kennan et al., 2002; Toronov et al., 2001).

Baseline fNIRS measurements for each individual were collected prior to the first assessment. Individuals were fitted with the fNIRS device prior to beginning the BAT. We obtained 10 s of resting fNIRS measurements. These readings were used as baseline measurements with active states during the public speaking task. Study staff members who analyzed and interpreted the fNIRS data were masked to treatment condition.

Relative concentration changes for oxygenated hemoglobin and deoxygenated hemoglobin, blood volume, and oxygenation were recorded throughout the experimental session every 500 ms. As cerebral blood volume level is a widely used measure of brain activation during completion of discrete tasks, we chose this marker for our analyses (Ogawa et al., 1992). Data were collected continuously across the entire testing period, and manual markers were used to indicate the beginning and ending of each resting period, baseline period, and the active speech phase. Observed variables from each active phase (pre-speech random dates, 4-min speech, post-speech random dates) were calculated by computing the difference from the preceding baseline phase to its active phase for each of the 16 voxels to account for individual differences in baseline brain activity. These data were reduced by averaging the values taken every 500 ms to calculate a single value per voxel for each task. Channels 11, 12, 13, and 14 were jointly examined as a region of interest in the right DLPFC, whereas Channels 3, 4, 5, and 6 corresponded to the left DLPFC (see Figure 2).

Treatments

Both treatments lasted 90 min and each contained an equal number of exposure exercises to equally distribute any effects of this key behavioral component. Advanced doctoral students in clinical psychology conducted all data collection and treatment interventions under the supervision of the second and third authors, who are both PhD-level faculty psychologists with expertise in both tCBT and ABBT treatments for anxiety disorders. The graduate students received extensive training and had significant experience delivering both treatments. All sessions in both conditions were audio-recorded and monitored for treatment adherence.

The individual tCBT treatment focused on symptom management and reality testing designed to help participants enhance their adaptive coping skills. This treatment taught individuals how to recognize automatic thoughts related to their anxiety about public speaking (e.g., “my mind will go blank,”



Figure 2. Location of fNIRS detectors.

“everyone thinks I’m stupid”). Participants were taught how to recognize and dispute the underlying cognitions related to their anxiety by testing the validity of dysfunctional and irrational cognitions and identifying distorted thinking. Using cognitive restructuring techniques, these individuals were taught to reframe their distorted thoughts in a more accurate way. These strategies were rehearsed during practice exposures as part of the treatment. Participants were encouraged to use these strategies whenever they deemed them necessary or helpful. The primary foci of this intervention were psychoeducation about anxiety, identifying and testing automatic thoughts, and creating rational responses during speech exposures. Each participant engaged in eight, 2-min speech exposures during the intervention with the therapist as the audience to practice utilizing skills in the moment. Speech topics were selected by the therapist and standardized across conditions.

The treatment delivered in the ABBT condition (Hayes et al., 1999; Herbert, Forman, & Dalrymple, 2009) began by addressing the ineffectiveness of participants' past attempts to control or reduce their anxiety in public speaking situations. As a more workable alternative to these control attempts, we introduced the notion of psychological acceptance of one's private experiences (thoughts, feelings, sensations) in the service of improved outwardly focused attention and enhanced speech performance. Treatment also focused on "willingness" to experience unwanted thoughts and feelings while simultaneously engaging in valued activities, especially those related to public speaking. Another key concept, cognitive defusion, taught participants to view themselves as separate from their internal experiences, thereby allowing the private experiences to occur without preventing the participant's engagement in exposure exercises. To help participants practice utilizing defusion to achieve "gentle refocusing," we asked them to stand up and give a brief talk during the treatment portion of the study (without an audience). During this task, the interventionist reads the participant's thoughts aloud as the participant practices noticing the thoughts while refocusing his or her attention to the speech task. This exercise teaches the participant to create distance between themselves and their internal experiences (e.g., thoughts) and to gently redirect attention to valued activities. Although similar to ACT, our intervention was too short to incorporate all of the core strategies from this intervention (e.g., "passengers on a bus" and "eulogy" metaphors, "milk milk milk" exercise), and it incorporated some techniques not explicitly part of ACT (i.e., "gentle attentional refocusing"). Participants in the ABBT condition were also encouraged to use these strategies whenever they deemed them necessary or helpful. The primary foci were psychoeducation about anxiety and practicing acceptance, defusion, and willingness techniques during speech-like exposures. Each ABBT participant also engaged in eight, 2-min speech exposures during the intervention.

Procedure

After providing informed consent, participants completed demographic questionnaires and the psychodiagnostic structured interview to determine current diagnosis, psychotropic medication use, any history of neurological and psychiatric illness, and drug and alcohol use. All participants met criteria for a primary diagnosis of PSA via the ADIS; advanced doctoral students in clinical psychology, who were trained by PhD-level principal investigators and attended weekly supervision, were responsible for completing SCID and ADIS assessments. Participants were randomly assigned to either the ABBT or tCBT treatment, and participated in two study assessments over the course

of study participation. All procedures were completed during a single study session lasting approximately 3 hr.

After screening, the first assessment (the BAT) was administered. Each BAT started with a date-naming control task, which was followed by an impromptu speech and then another date-naming control task. fNIRS readings were taken throughout the BAT, and participants completed a questionnaire packet immediately following the BAT during both pre- and post-treatment assessments. Next, participants received the 90-min treatment, took a short break, and completed the second, post-intervention BAT assessment.

Questionnaires were completed on a computer in the treatment room. Each participant was allowed as much time as necessary to ask questions following participation in the study. After debriefing, participants were asked to complete a feedback questionnaire regarding how helpful they felt the intervention would be at reducing their anxiety in the future. Clinical psychology doctoral students served as study assessors, and were trained and supervised by licensed psychologists with expertise in the assessment and treatment of anxiety disorders and who concurred with all diagnoses.

Self-reported SUDS levels were obtained at 30-s intervals throughout the speech, for a total of eight SUDS levels over the 4-min BAT speech. For the purpose of data analysis, speech SUDS levels were averaged to create a single SUDS rating to represent a subjective speech anxiety level unless otherwise noted.

Approximately 20% of treatment tapes were randomly selected from all possible sessions and assessed by the first author using a treatment integrity form to determine adherence to each manual. Sessions were also evaluated to ensure that therapists did not discuss traditional cognitive therapy strategies during the ABBT intervention and did not discuss acceptance-based strategies in the tCBT intervention. Results of this review showed 100% adherence to the treatment manuals based on an abbreviated checklist of major treatment components, with no errors in treatment fidelity (e.g., using an ABBT metaphor or acceptance-based explanation to a question within the tCBT intervention).

Results

Preliminary Analyses

The two treatment conditions were compared on demographic, outcome, and process variables at baseline using *t* tests (Table 1). Primary variables were tested for skewness, kurtosis, homogeneity of variance, and outliers to verify

Table 1. Descriptive Statistics for Outcome Measures at Pre-Treatment by Group.

Measure	Standard cognitive-behavioral intervention		Acceptance-based behavioral intervention	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	29.91	11.29	26.10	6.49
Word fluency	35.56	9.75	39.67	11.27
Pre-treatment anxiety (SUDS)	56.29	19.24	47.13	19.22
Pre-treatment performance (SPS)	33.67	3.83	34.75	3.37
Blood volume, left hemisphere, speech average	1.91	1.53	2.22	2.40
Blood volume, right hemisphere, speech average	3.22	1.52	2.41	2.71

Note. SUDS = Subjective Units of Discomfort Scale; SPS = Speech Performance Scale.

that all of the assumptions were met for the ANOVA model; we did not find any violations. Means and standard deviations for all main outcome variables measured during the pre-intervention BAT can be found in Table 2. Given that this was a pilot study with a relatively small sample size, many of our analyses were underpowered. Thus, in consideration of the pilot nature of this study, we sometimes relied on examination of effect sizes rather than relying solely on tests of statistical significance.

To determine whether the BAT speech activated participant’s anxiety, we ran a one-way repeated-measures ANOVA examining the effect of time (pre-speech control task, speech, post-speech control task) on SUDS level during the pre-treatment BAT. The effect of time was significant, $F(1, 18) = 64.6$, $p < .01$, $\eta_p^2 = .80$. As expected, Tukey’s post hoc tests revealed that subjective anxiety levels significantly increased between the baseline date-naming task and the speech, and then significantly decreased between the speech and the post-speech date-naming task. These results confirm that participants experienced an increase in subjective anxiety concurrent with the speech task.

Effects of the Treatments on Anxiety and Performance

To evaluate whether participants experienced a reduction in anxiety (measured by SUDS) and an improvement in performance (measured by SPS) from pre- to post-treatment, as well as to examine differences between the treatments, we conducted a series of repeated-measures ANOVAs.

Table 2. Descriptive Statistics for Outcome Measures at Pre-Treatment Across the Pre-Treatment Assessment.

Measure	Pre-speech date-naming control task		Speech (4-min averages)		Post-speech date-naming control task	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pre-treatment anxiety (SUDS)	22.19	18.72	50.94	19.41	19.00	16.50
Pre-treatment performance (SPS)	—	—	34.24	3.54	—	—
Blood volume, left hemisphere	0.19	0.76	1.70	2.22	-0.28	0.90
Blood volume, right hemisphere	0.66	1.26	2.87	1.92	-0.40	1.00

Note. SUDS = Subjective Units of Discomfort Scale; SPS = Speech Performance Scale.

Table 3. Repeated-Measures ANOVA Examining Pre- to Post-Treatment Changes in Self-Reported Anxiety (Measured by SUDS) and Observer-Rated Anxiety (Measured by SPS).

Measure	SUDS	SPS
<i>F</i> values	40.94**	36.68**
Effect size (η_p^2)	.75	.71

Note. * $p < .01$; SUDS = Subjective Units of Discomfort Scale; SPS = Speech Performance Scale.

As predicted, individuals experienced a very large and statistically significant decrease in anxiety and improvement in performance between pre- and post-treatment (Table 3). There was a strong trend toward lower self-reported anxiety levels at post-treatment in the tCBT condition compared with the ABBT condition ($F = 4.04$, $p = .06$, $\eta_p^2 = .22$; Figure 3); however, observer-rated performance was significantly higher at post-treatment for those in the ABBT condition ($F = 38.88$, $p < .05$, $\eta_p^2 = .24$; Figure 4).

Effects of the Interventions on PFC Activation

We next examined differences in brain activation between treatment conditions and cerebral hemispheres. As verbal speech production is associated with predominantly left PFC activity (see McCarthy & Warrington, 1990), we ran preliminary analyses to examine whether there were differences in

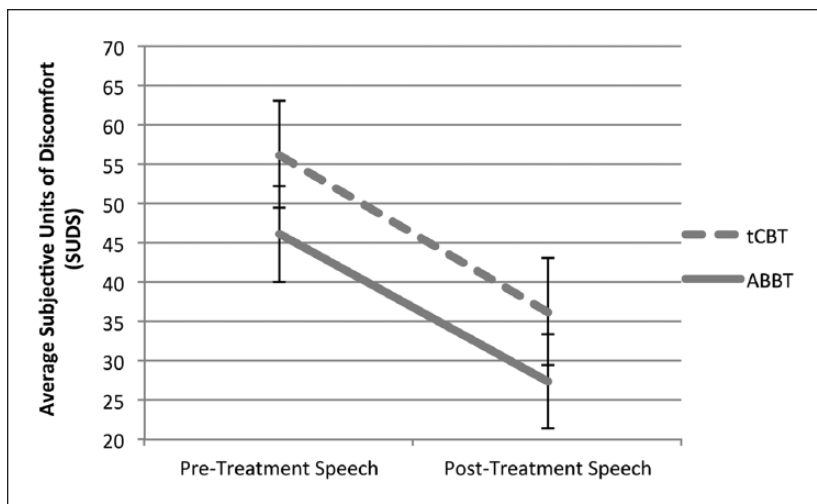


Figure 3. Changes in self-reported anxiety (measured by SUDS) from pre-treatment to post-treatment during the Behavioral Assessment Test.

Note. SUDS = Subjective Units of Discomfort Scale; tCBT = traditional cognitive-behavior treatment; ABBT = acceptance-based behavior treatment.

speech word counts between conditions. Results indicated no significant differences in word count between treatment conditions during the pre- or post-treatment speeches ($t = .94, p = .36, d = .44$; $t = .55, p = .60, d = .27$, respectively). Change in word production was also unaffected by condition ($t = .40, p = .61, d = .20$).

Blood volume. We ran 2 (treatment condition) \times 2 (pre- or post-intervention assessment occasion) ANOVAs for each hemisphere. Results revealed a large effect for time in the right hemisphere with blood volume levels decreasing between pre- and post-treatment ($F = 3.14, p = .11, \eta_p^2 = .22$), and no effect for time in the left ($F = 0.04, p = .85, \eta_p^2 < .01$). We did not find a main effect treatment condition in either hemisphere. The treatment condition by time interaction effect was small and non-significant in the right hemisphere ($F = 0.08, p = .78, \eta_p^2 < .01$). The interaction effect was moderate, but not significant, in the left hemisphere ($F = 1.26, p = .28, \eta_p^2 = .10$), with blood volume levels decreasing in the ABBT condition ($d = .21$) and increasing in the tCBT condition ($d = .42$). Despite a lack of significance, the moderate effect may indicate that a true relationship between treatment condition and time does exist. An examination of effect sizes and visual inspection of the data (see

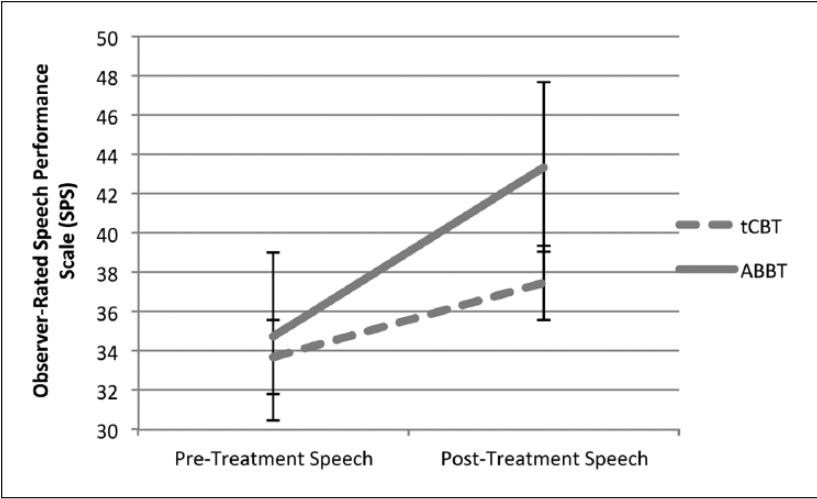


Figure 4. Changes in observer-rated speech performance (measured by SPS) from pre-treatment to post-treatment during the Behavioral Assessment Test.
Note. tCBT = traditional cognitive-behavior treatment; ABBT = acceptance-based behavior treatment.

Figure 5) suggests a moderate interaction of time and condition on blood volume level in the left hemisphere, with blood volume decreasing in the ABBT condition and increasing in the tCBT condition over time. These results suggest that participants may show differential hemispheric activity from pre- to post-treatment between treatment conditions. These analyses are exploratory given our low sample size, and are in need of replication. As such, we have interpreted patterns that have emerged at trend levels.

Discussion

PSA is a common condition that can be both professionally and personally debilitating. Despite its high prevalence, there has been a paucity of research on PSA specifically. Existing data suggest that tCBT is moderately effective, but a significant number of patients do not show improvement or have residual symptoms following treatment. A number of acceptance-based models of CBT for anxiety disorders have emerged, raising the question of how these models compare in efficacy to tCBT and whether acceptance-based and traditional tCBT treatments have different treatment mechanisms. Whereas several large randomized controlled trials have examined treatment differences

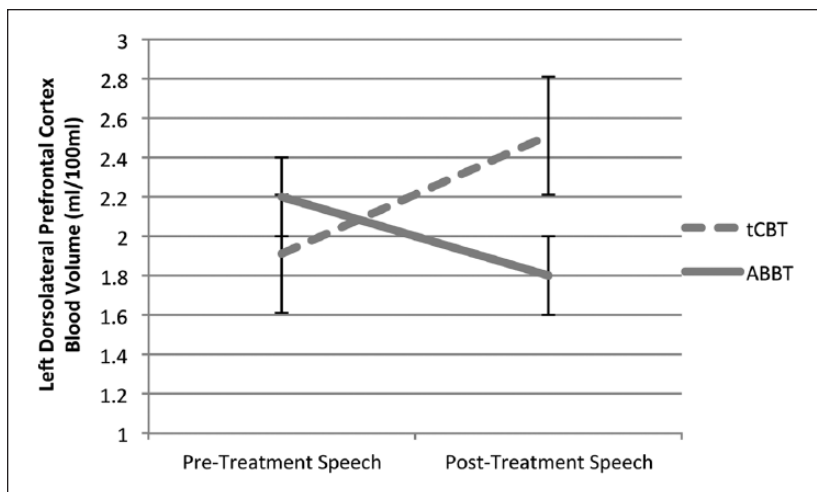


Figure 5. Changes in blood volume in the dorsolateral prefrontal cortex (DLPFC) from pre-treatment to post-treatment during the Behavioral Assessment Test.

Note. tCBT = traditional cognitive-behavior treatment; ABBT = acceptance-based behavior treatment.

in psychological factors, these studies have not focused on a PSA population and have largely ignored performance outcomes for this group. Furthermore, neurophysiological differences between treatments have not been adequately examined.

Given recent research suggesting that efforts to control anxiety can tax cognitive resources and reduce an individual's ability to maximally perform at tasks similar to giving a speech, we sought to compare the impact of brief tCBT and ABBT interventions on anxiety and performance in a sample of patients with PSA. Second, we investigated the effects of treatment on neurophysiological measures.

Support was found for the acceptability and efficacy of both brief interventions, as all participants experienced both reductions in anxiety and improvements in speech performance. There are several possible factors that could have contributed to this finding. First, habituation and practice effects may have affected anxiety reduction across groups as participants engaged in 12 min of exposure practice during each intervention. At post-intervention, participants reported that they felt the treatment was successful at reducing their PSA-related fears and that they felt confident that continued practice

would eliminate their fears over time. Feelings of empowerment or confidence may have been instilled through a positive therapeutic alliance, psychoeducation/normalization, or the ease and directedness of the skills presented in each intervention combined with direct practice of each skill. Ultimately, these factors may have also affected the gains seen in our 90-min protocol. Unfortunately, we do not know if any of these changes would have been maintained, as we did not include a follow-up assessment.

When comparing conditions, tCBT demonstrated greater reductions in subjective anxiety, although results only approached significance, while ABBT demonstrated greater efficacy in improving observer-rated performance during the speech. Traditional CBT techniques, such as reality testing and cognitive restructuring, require considerable self-focus, and may tax working memory and attention more than ABBT strategies, thereby potentially negatively affecting speech performance. ABBT strategies may free more cognitive resources for engaging in behaviors related to speech performance (e.g., concentrating on one's speech volume, diction, vocabulary, or clarity). Furthermore, it is possible that the tCBT goal of anxiety reduction may lead to increased efforts to manage anxiety, thus demanding greater cognitive resources as well.

Although only detectable at trend levels, the differences observed between the two interventions, as well as the notion that tCBT may tap more cognitive resources than ABBT, are consistent with differing patterns of brain activation between the two treatments. Individuals in the ABBT condition tended to show a decrease in blood volume in the left DLPFC, whereas those in the tCBT condition tended to display an increase in blood volume levels in that brain region. As the left hemisphere is associated primarily with language functions, these findings suggest tCBT techniques may have encouraged greater use of verbal processes during the post-intervention speech. As speech word count was equivalent between treatment groups, this reduction in activation appears not to be due simply to overt verbal production per se. The left DLPFC has also been implicated in impulse control (Steinbeis, Bernhardt, & Singer, 2012) and the ability to direct information in working memory (Barbey, Koenigs, & Grafman, 2013). As such, it is also possible that individuals in the ABBT group experienced less pressure on their working memory systems (which could be related to less verbal content) or a reduced need to control impulses (which is compatible with the acceptance-based model). Theoretically, both alternate explanations could have also precipitated the greater improvements in performance demonstrated by the ABBT condition.

Although exploratory in nature, our results support the assertion that ABBT and traditional tCBT are somewhat distinctive interventions. Furthermore, they raise the possibility that acceptance-based treatments may

free working memory resources (that may help regulate internal processes such as reframing of cognitive distortions) more than tCBT, which may result in greater improvements in objectively rated behavioral performances for the former. However, these results are preliminary and many only describe trend-level effects and should be interpreted with caution.

Strengths and Limitations

This study is one of few to examine behavioral performance in a PSA outcome study. Individuals with PSA often experience deficits in speech performance that can affect their career, education, or personal success. Thus, accurately assessing treatment effects on social performance is a critical element of PSA interventions (Leserman & Koch, 1993). Utilizing both observer-rated and subjective measures in the same protocol can create a clearer picture of the effects of treatment.

This study is also the first to examine changes in brain activation in a PSA population, and to compare changes in brain activation between treatment interventions. The detection of trends of differential neurophysiological changes between ABBT and tCBT supports the continued examination of ABBT as a distinctive intervention for anxiety disorders. Furthermore, localization of the specific brain changes associated with each intervention may eventually allow targeted treatments based on baseline neurophysiological presentations.

Although we were able to demonstrate noteworthy differences between ABBT and tCBT after a brief intervention for PSA, there are several limitations to consider when interpreting the results. First and foremost, the study had a relatively small number of participants. Some of our findings are based on effect sizes and visual inspection of data in the context of statistical trends that did not approach conventional levels of significance, particularly in the case of interaction effects on fNIRS measures. This study utilized a single-session protocol, and the effects of treatments may differ once scaled up. A related limitation concerns the absence of a follow-up assessment, meaning that no conclusions can be drawn about the long-term efficacy of either treatment. The study also lacked a no-treatment control condition or an exposure-only control. Even though individuals may have improved following an exposure-only intervention, this does not explain differences found in anxiety, performance, and brain activation outcomes between the ABBT and tCBT interventions, which contained equal doses of exposure. Although prior research has demonstrated that social anxiety tends not to improve without treatment, this possibility cannot be ruled out. Furthermore, there is evidence that right-sided PFC activity has been linked to task novelty (Goldberg,

2009); therefore, it cannot be ruled out that the increased right DLPFC activation levels were caused by novel study tasks. However, the differential effects observed between the treatment groups mitigate this concern. There are also important drawbacks associated with the limited depth perception of fNIRS technology. Given the importance of the limbic system in the expression of anxiety, our inability to examine deeper brain structures precludes consideration of subcortical activity.

Future Directions

Although preliminary, our results suggest that brief, 90-min CBT treatments can have beneficial effects on anxiety and performance among persons with clinically significant PSA. Future research is needed to examine the long-term efficacy and utility of brief treatments for PSA. These results will hopefully encourage an examination of the differential effects of tCBT and ABBT treatments on cognitive resources and behavioral performance in a larger sample to ensure proper statistical power for all analyses. Our research group is currently examining the relationship between verbal working memory and speech performance in individuals with PSA, and whether tCBT or ABBT treatments affect this relationship. In addition, future studies may consider inclusion of a no-treatment control group. Larger samples would also permit formal tests of statistical mediation.

Continued investigation into the neurological correlates of PSA and its treatment may provide a better understanding of the brain mechanisms associated with speech anxiety and may lead to more effective treatments. For example, researchers are now examining the efficacy of rTMS for the treatment of anxiety disorders (see Pallanti & Bernardi, 2009, for a review). Research examining the differential patterns of brain arousal may also eventually help determine whether baseline brain patterns predict differential response to different treatments for PSA.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: The imaging device used in this study is manufactured by fNIR Devices, LLC. This company is one of our University's spinoffs, and the technology and software development have been disclosed and protected by the University. Our sixth author has an ownership interest in this company.

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