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A Controlled Study of Virtual Reality Exposure Therapy for the Fear of Flying

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ABSTRACT

Fear of flying (FOF) affects an estimated 10—25% of the population. Patients with FOF (*N* = 49) were randomly assigned to virtual reality exposure (VRE) therapy, standard exposure (SE) therapy, or a wait-list (WL) control. Treatment consisted of 8 sessions over 6 weeks, with 4 sessions of anxiety management training followed by either exposure to a virtual airplane (VRE) or exposure to an actual airplane at the airport (SE). A posttreatment flight on a commercial airline measured participants' willingness to fly and anxiety during flight immediately after treatment. The results indicated that VRE and SE were both superior to WL, with no differences between VRE and SE. The gains observed in treatment were maintained at a 6-month follow up. By 6 months posttreatment, 93% of VRE participants and 93% of SE participants had flown. VRE therapy and SE therapy for treatment of FOF were unequivocally supported in this controlled study.

Fear of flying (FOF) is a significant problem, affecting an estimated 10% to 25% of the population (Agras, Sylvester, & Oliveau, 1969 ; Deran & Whitaker, 1980), or approximately 25 million adults in the United States (Deran & Whitaker, 1980). In addition, approximately 20% of those who do fly depend on alcohol or sedatives during flights (Greist & Greist, 1981). Avoidance of flying causes sufferers serious vocational and social consequences.

Several FOF programs have been described and tested, including stress inoculation training, systematic desensitization, flooding, implosion, and relaxation treatments (Beckham, Vrana, May, Gustafson, & Smith, 1990 ; Haug, Brenne, Johnson, Berntzen, Gotestam, & Hugdahl, 1987 ; Howard, Murphy, & Clarke, 1983), but many have been criticized for not including a posttreatment flight to evaluate outcome (Haug et al., 1987). The difficulty and expense of using actual airplanes and flights for exposure have daunted many researchers and therapists despite the prevalence and impact of FOF. Some FOF programs exist in large metropolitan cities, often sponsored by airlines, but these programs have not been subjected to rigorous evaluation.

Virtual reality (VR) offers a new human—computer interaction paradigm in which users are no longer simply external observers of images on a computer screen but are active participants within a computer-generated three-dimensional virtual world. Virtual environments differ from traditional displays in that computer graphics and various display and input technologies are integrated to give the user a sense of

presence or *immersion* in the virtual environment. The most common approach to the creation of a virtual environment is to outfit the user in a head-mounted display. Head-mounted displays consist of separate display screens for each eye, along with some type of display optics, stereo earphones, and a head-tracking device. The user is presented with a computer-generated view of a virtual world that changes in a natural way with head and body motion.

What distinguishes VR from a mere multimedia system or an interactive computer graphics display is a sense of presence. A sense of presence is also essential to conducting exposure therapy. Researchers of emotional processing theory as it is applied to anxiety disorders (Foa & Kozak, 1986 ; Foa, Steketee, & Rothbaum, 1989) purport that fear memories can be construed as structures that contain information regarding stimuli, responses, and meaning. Therapy is aimed at facilitating emotional processing. It has been proposed that, for this to occur, the fear structure must be activated and modified. Exposure therapy, in which the patient is intentionally confronted with the feared stimuli in a therapeutic manner, activates the fear structure through confrontation with the feared stimuli, which elicits the fearful responses. The processes of habituation and extinction in which the feared stimuli cease to elicit anxiety aid modification of the fear structure, making its meaning less threatening. Any method capable of activating the fear structure and modifying it would be predicted to improve symptoms of anxiety. Thus, VR exposure therapy (VRE) has been proposed as a new medium for exposure therapy.

Rothbaum et al. (1995) conducted the first controlled study applying VR to the treatment of a psychological disorder: VRE was incorporated in the treatment of acrophobia. Participants were repeatedly exposed to virtual foot bridges of varying heights and stability, outdoor balconies of varying heights, and a glass elevator that ascended 50 floors. VRE was effective in significantly reducing fear of and improving attitudes toward heights, whereas no change was noted in the control group. Seven out of the ten VRE treatment completers exposed themselves to height situations in real life during treatment although they were not instructed to do. Physical symptoms of anxiety described by the participants while in virtual height situations included sweating, abdominal discomfort usually described as "butterflies," loss of balance or light-headedness, heart palpitations, pacing, tremulousness or shaking, feeling nervous or scared, weakness in the knees, tightness in the chest, and feeling tense (Hodges et al., 1995). VRE has also been effective in two case studies of patients with FOF (Rothbaum, Hodges, Watson, Kessler, & Opdyke, 1996 ; Smith, Rothbaum, & Hodges, 1999) and in a case study treating a person with spider phobia (Carlin, Hoffman, & Weghorst, 1997).

VRE is potentially an efficient and cost-effective treatment of FOF. The current study sought to determine the relative efficacy of VRE and standard exposure (SE) compared with wait list (WL) control in the treatment of FOF. It was predicted that (a) VRE would be more effective than WL control in reducing participants' FOF and avoidance behavior and (b) VRE and SE would be equally effective in reducing participants' FOF and avoidance behavior.

Method

Forty-nine patients with FOF were randomly assigned to one of three groups: VRE, SE, or WL. Forty-five patients completed, resulting in 15 completers per group. In addition to standard paper and pencil measures pre- and posttreatment and at follow-ups of 6- and 12-months posttreatment, a posttreatment test flight was conducted to assess participants' anxiety and avoidance for an actual airplane flight. All assessments were conducted by an independent assessor.

Participants

To participate in this project, all participants had to meet current *Diagnostic and Statistical Manual of*

Mental Disorders (4th ed.; American Psychiatric Association, 1994) criteria for either specific phobia, situational type, panic disorder with agoraphobia, or agoraphobia without a history of panic disorder with flying as the feared stimulus. Only participants who had flown before were eligible (Beckham et al., 1990 ; Howard et al., 1983). Eligible patients on psychoactive medication must have been on that dose and medication for at least 3 months and had to agree to remain on that dose throughout the project. Participants with a history of mania, schizophrenia, or other psychoses; with prominent suicidal ideation; or with current alcohol or drug abuse or dependence were excluded.

Analyses of variance (for age, years of education, and income) and chi-square analyses (for gender, race, marital status, and primary diagnosis) revealed no significant differences between groups on any demographic characteristic or pretreatment variable ($p > .05$). Participants ranged in age from 24 to 69, with a mean age of 40.5. The sample was relatively wealthy and well educated, with a mean level of 16.5 years of education and with most participants (64%, $n = 29$) reporting household incomes of $50,000 or more. The majority of participants were female (71%, $n = 32$), Caucasian (82%, $n = 37$), and married (71%, $n = 32$).

The majority of participants received a primary diagnosis of specific phobia, situational type (flying; 93%, $n = 42$). The remaining participants received a primary diagnosis of panic disorder with agoraphobia (7%, $n = 3$). Most participants received only one current diagnosis (67%, $n = 30$); however, 24% ($n = 11$) received two diagnoses and 9% ($n = 4$) received three diagnoses. Specific phobia of heights was the most common secondary or tertiary diagnosis (occurring in 53% of those with more than one diagnosis, $n = 8$). Consistent with diagnoses of specific phobia and agoraphobia, at screening all participants reported either avoiding flying entirely or enduring flying with great discomfort. Interrater reliability of diagnostic judgments was calculated for the three clinician raters. Mean overall diagnostic agreement was 92% (range = 87—96%).

Four individuals (3 VRE and 1 SE) withdrew prematurely from the study: Two dropped out after the initial formal assessment but prior to the first session, 1 dropped out after one session because of scheduling problems and uncertainty about the benefits from treatment, and the 4th was withdrawn from the study by the investigators after two sessions because of protocol violations (change in psychotropic medication). Analyses of variance indicated that the dropouts as a group were not significantly different from completers with two exceptions: They reported higher levels of state anxiety ($p < .05$) than had completers at pretreatment and reported lower income levels ($p < .05$). Demographic characteristics of completers can be found in Table 1.

Measures

The Questionnaire on Attitudes Toward Flying (QAF; Howard et al., 1983) assesses history of FOF, previous treatment, and attitudes toward flying. It includes a 36-item questionnaire rating the level of fear on an 11-point scale ranging from 0 (*no fear*) to 10 (*extreme fear*) in different flying situations. The possible range of scores is 0 to 360. Test—retest reliability was .92, and split-half reliability was .99. The QAF Fear item is a subscale of this measure and asks the participant to rate, using a Likert-type scale ranging from 0 to 10, his or her present FOF. Reports of the total number of anxiety symptoms the participant typically experienced when flying (Fear of Flying Interview [FOFI]; McNally & Louro, 1992) were significantly correlated with both the QAF total score ($r = .32$, $p < .05$) and the QAF Fear item ($r = .52$, $p < .001$). The FOFI assesses whether the fear of flying is a symptom of agoraphobia or a simple phobia. It has been found to discriminate between agoraphobic and simple phobic patients with a fear of flying.

The Structured Clinical Interview for the *DSM—IV* (SCID; First, Spitzer, Gibbon, & Williams, 1995) was given to screen Axis I disorders as well as establish comorbid diagnoses.

The Clinical Global Improvement (CGI) Scale is a global measure of change in severity of symptoms. The scale ranges from 1 (*very much improved)* to 4 (*no change*) to 7 (*very much worse*). It has been used extensively in clinical trials (Guy, 1976).

The Fear of Flying Inventory (FFI; Scott, 1987) is a 33-item scale measuring intensity of FOF. Items are rated on a 9-point scale ranging from 0 (*not at all*) to 8 (*very severely disturbing*). Test—retest reliability for 15 WL patients was .92, and it has been sensitive to change with treatment. Reports of the total number of anxiety symptoms the participant typically experienced when flying (Fear of Flying Interview) were significantly correlated with FFI score ($r = .45$, $p < .01$).

Apparatus

The computer system used in the current study consisted of a 300 MHz Pentium II processor with 128 MB memory, a SCSI disk drive, and a Fire GL 1000 video card. A Virtual Research VR6 (Virtual Research Systems, Santa Clara, CA) head-mounted display with stereo earphones transmitted the VR image to the participant. The participant was seated in a Thunderseat ® (Thunderseat, Los Angeles, CA), a specially designed seat with an embedded 100-watt subwoofer and an attached airplane seatbelt. The virtual airplane software for FOF was created by Virtually Better, Inc. (Atlanta, GA; www.virtuallybetter.com). VR-generated scenes placed participants in a passenger seat by the window on a commercial airplane. As they moved their heads to the left, they were able to see out the left-hand window. As they moved their heads to the right, the empty seats to the right side of the airplane and the right side window came into view.

Procedure

If appropriate following phone screening, an initial evaluation was scheduled to evaluate patients as to inclusion and exclusion criteria and explain the procedures of the project in detail. The patients signed a consent form at this time and the SCID was administered. Following entry into the study, the pretreatment assessment was conducted and all measures were administered. The posttreatment assessment was conducted individually after 6 weeks for all participants. WL participants were assessed at the same pre- and posttreatment points in time as the treatment participants but did not have any treatment in between. They were scheduled for their flights at the same point in time as the treated participants. For ethical reasons, WL participants were offered the treatment of their choice (VRE or SE) following the flight. Six- and 12-month follow-up assessments were conducted using the same measures as at the posttreatment assessment. All patients were asked to participate in a posttreatment or post-WL behavioral avoidance test consisting of an actual round-trip flight accompanied by the therapist. No one was forced or coerced, however. Group flights of approximately 5 participants and one therapist each were scheduled on Delta Airlines between Atlanta and Houston, approximately 1.5 hours per flight. Patients were asked to pay $164 each for their flights to (a) increase motivation, (b) offset study costs, (c) ensure that people didn't sign up for a free flight, and (d) more closely match the real world. Delta agreed to provide full refunds if flights were not taken. Group flights were used to offset study costs. It was prohibitively expensive for the therapist to accompany 45 patients on individual flights.

Treatment

Participants were treated for eight individual sessions over 6 weeks. VRE and SE groups received identical treatment for Sessions 1 to 4 lasting approximately 1 hr each. The first session for both VRE and SE lasted approximately 90 min and was spent in information gathering, treatment planning, and explaining the rationale to the patient. Brief breathing retraining was taught to manage physical signs of anxiety such as increased heart rate. Cognitive restructuring to learn how to challenge irrational thoughts

was taught in the second treatment session. Typical irrational thoughts included "This plane is going to crash" and "I will panic on this plane and [embarrass myself/go crazy/die/have a heart attack]." Thought-stopping to counter ruminative thinking was taught in Session 3. Session 4 reviewed these three anxiety management techniques, spent more time on cognitive restructuring, and taught hyperventilation exposure if the patient reported a history of panic attacks. Exposure was conducted in Sessions 5 to 8.

VRE of sitting in an airplane, experiencing take-offs and landings in an airplane, and flying in both calm and stormy weather were provided twice weekly for 2 weeks in Virtually Better, Inc.'s office, according to a treatment manual developed by the authors (Rothbaum & Hodges, 1997). The patient chair is equipped with a woofer under the seat to add noise and vibrations at appropriate times in the flight. Recorded sounds of flight attendants, takeoffs, landings, and weather effects on the outside of the airplane were included. The therapist made appropriate comments and encouraged continued exposure until anxiety decreased. The patient was allowed to progress at his or her own pace in the preset order of the hierarchy of exposures: sitting on plane, engines off; sitting on plane, engines on; taxiing; take-off; smooth flight; landing; and thunderstorm and turbulent flight.

SE was conducted at the airport. Because of the time required for travel to and from the airport, parking, and in vivo exposure, Sessions 5 and 6 were combined into one extended session and were spent at the airport exposing patients to the preflight stimuli (e.g., ticketing, trains, parked planes, and waiting area). Sessions 7 and 8, also combined into one extended session, were spent on a stationary airplane to allow habituation to airplane stimuli and time for imaginal exposure (i.e., imagining takeoffs, cruising, landing, etc.).

Exposure components could not be made 100% equal between VRE and SE because of real world constraints, so they were arranged to naturalistically match what would occur before an actual flight. In VRE, this was the above exposure hierarchy. In SE, this was going to the airport and sitting on a stationary airplane. The time spent in exposure and with the therapist was equal.

Results

Statistical Analysis

We examined the FFI and QAF data descriptively by treatment and control groups for normality by using skewness and kurtosis coefficients (*z* tests of greater or less than 1.96) and the Shapiro-Wilks test where indicated. Homogeneity of variance was examined across the treatment and control (factor) groups by the (dependent) variables by using the Levene test ($\alpha = .05$) for univariate homogeniety of variance. Additionally, the Box test ($\alpha = .05$) was performed to determine the equality of the covariance matrices between treatment groups in the multivariate repeated measures analysis models. The requisite assumptions for using multivariate normal parametric statistical techniques were met in almost all analyses. In instances in which nonnormality, heterogeneity of variance, or both were present in the data, we performed transformations to use parametric statistical techniques.

After data screening for general linear model assumptions, three K-group, split-plot multivariate repeated measures analyses, across two measures (pretest and posttest), were performed on the dependent variables FFI, QAF, and QAF Fear by WL control, VRE, and SE. If significant, one-tailed analyses of variance were conducted on individual variables (Cohen, 1988 ; Maxwell & Delaney, 1990 ; Stevens, 1996 ; SPSS, 1998).

Repeated Measures Analysis Results for QAF

The overall *F* test for the QAF Pretest—Posttest × Group analysis was F (4, 72) = 5.54, $p < .01$, with an effect size of 0.24 standard deviation units. Tests of simple effects detected a significant reduction in QAF measures for both treatment groups when compared with the WL group. Significant mean differences were detected between the WL and SE groups, F (1, 25) = 6.64, $p < .01$, with an effect size of .37 and between the WL and VRE groups, F (1, 25) = 9.75, $p < .01$, with an effect size of .45. Table 2 contains means and standard deviations for participants in the three conditions at pre- and posttreatment on the FFI, QAF, and QAF Fear.

Repeated Measures Analysis Results for QAF Fear

The overall *F* test for the QAF Fear Pretest—Posttest × Group analysis was F (4, 66) = 10.06, $p < .001$, with an effect size of .38 standard deviation units. Tests of simple effects yielded a significant reduction in QAF Fear measures for the VRE and SE groups when compared with the WL group. Specifically, significant mean differences were found between the WL and VRE groups, F (1, 25) = 25.00, $p < .001$, and between the WL and SE groups, F (1, 25) = 16.43, $p < .001$, with effect sizes of .70 and .62, respectively.

Repeated Measures Analysis Results for FFI

The overall *F* test for the FFI Pretest—Posttest × Group analysis was F (4, 72) = 3.27, $p < .05$, with an effect size of .15 standard deviation units. Tests of simple effects demonstrated a significant reduction in FFI scores for the VRE group compared with the WL control group. Specifically, a significant difference was noted between WL and VRE groups, F (1, 25) = 3.62, $p < .05$, with an effect size of .23 standard deviation units.

Repeated Measures Analyses for the FFI, QAF, and QAF Fear for 6-Month Follow-Up Data

To assess the degree to which participants in each active therapy maintained or did not maintain treatment gains over the course of the 6-month follow-up period, additional analyses were performed. Only VRE and SE groups were compared in these analyses as the WL participants received treatment following their wait list period. For ethical reasons, WL participants were allowed to choose their treatment, and thus were not randomly assigned and are not included in 6-month follow-up analyses here. Of the 15 WL participants, 14 chose VRE and 1 chose SE. A repeated measures analysis was conducted using the SE and VRE as the between-groups factor and the posttreatment FFI score to 6-month follow-up FFI score as the within-subjects factor. No significant differences were detected on the FFI between the posttreatment score and the 6-month follow-up score, indicating that as a group, treated participants maintained treatment gains over the 6-month follow-up period. Paired *t* tests further revealed significant mean differences between the post-FFI and 6-month follow-up FFI score for the SE group. The associated effect size for this finding was .40 standard deviation units, indicating a further reduction in FFI scores from the posttest FFI to 6-month follow-up FFI for the SE group. For the VRE group, no significant differences were found between the posttreatment and 6-month follow-up FFI scores, providing evidence for a sustained treatment effect from posttest to 6-month follow-up.

QAF scores were examined in the same manner. A repeated measures analysis was conducted using SE and VRE as the between groups factor and the mean posttreatment QAF score to mean 6-month follow-up QAF score as the within-subjects factor. No significant differences were detected between the VRE and SE groups across the within-subjects QAF factor. Additionally, paired *t* tests conducted separately by group revealed no significant mean differences between the post QAF and 6-month follow-up QAF measures for either the VRE or the SE group, indicating that participants in both treatment groups maintained the gains made during the treatment period on this measure.

Finally, the QAF Fear item was examined using the same procedures. A repeated measures analysis was conducted using the SE and VRE as the between-groups factor and the posttreatment QAF Fear to 6-month follow-up QAF Fear as the within-subjects factor. No significant differences were detected between the VRE and SE groups across the within-subjects QAF Fear factor. Additionally, paired *t* tests conducted separately by group revealed no significant mean differences between the posttest QAF Fear and 6-month follow-up QAF Fear measures for either the VRE or SE group, again indicating that the participants in both treatment groups maintained treatment gains over the follow-up period on this measure. Table 3 provides the means, standard deviations, and *F* ratios for the repeated measures analyses using posttest and 6-month follow-up measures.

Kruskal—Wallis Chi-Square Test for Posttreatment Flight

The Kruskal—Wallis chi square was performed to determine if there were differences between VRE, SE, and WL with respect to the likelihood of persons in each group taking a flight at the end of the treatment or wait list period. The overall result of the test detected significant differences between the groups, χ^2 (2, N = 45) = 11.93, $p < .01$. After analysis of group comparisons, the WL and VRE groups were found to differ significantly, χ^2 (1, N = 30) = 7.52, $p < .01$, as did the WL and SE groups, χ^2 (1, N = 30) = 11.24, $p < .01$. In both cases, VRE and SE groups were more likely to take their actual graduation flight. Eight of 15 VRE participants (53%), 10 of 15 SE participants (67%), and 1 of 15 WL participants (7%) took their posttreatment graduation flights. Logistic regression analysis revealed that after treatment, the SE and VRE groups were approximately 3.5 times more likely to take a flight than the WL control group. Subjective Units of Discomfort (SUDs; range = 0—100, in which 0 = no anxiety and 100 = maximum anxiety, i.e., anxiety) ratings taken during the actual flights indicated no differences between participants who received VRE and those who received SE. The average SUDs rating on the flight from Atlanta to Houston was 33.19 (*SD* =15.6) for VRE and 33.88 (*SD* = 16.3) for SE. The average SUDS rating on the return flight from Houston to Atlanta was 28.73 (*SD* = 13.3) for VRE and 29.77 (*SD* = 18.3) for SE.

At the 6-month follow-up evaluation, 11 of 14 (79%) VRE participants and 9 of 13 (69%) SE participants had flown since (but not including) the graduation flight. Overall, by the 6-month follow-up, 14 of 15 (93%) VRE participants and 14 of 15 (93%) SE participants had flown since the termination of treatment, either on the graduation flight or otherwise.

Posttest Rating of Improvement Variables

The Kruskal—Wallis chi-square test was performed on a posttest rating of self-improvement to determine whether there were differences between VRE and SE therapy groups on patient global ratings of improvement. On the CGI, a significant difference between the WL and VRE groups, χ^2 (1, N = 29) = 23.31, $p < .001$, and between the WL and SE groups, χ^2 (1, N = 30) = 25.20, $p < .001$, was detected such that participants who received either VRE or SE improved significantly more than did WL participants, with no significant differences between VRE and SE.

Posttreatment Client Satisfaction Ratings

There were no significant differences between VRE and SE participants on ratings of client satisfaction, which were very positive.

Discussion

In this controlled trial comparing VRE therapy, SE therapy, and a WL control for treatment of FOF, VRE and SE were shown to be equally effective both in decreases in symptoms as measured by standardized questionnaires and by the number of participants to actually fly on a real airplane following treatment. Regarding written measures and the number of participants to fly on a real airplane following treatment, VRE therapy was statistically indistinguishable from SE therapy, in which participants were exposed to an actual airplane. Anxiety ratings during the actual flight indicated that VRE-treated patients were as comfortable as SE-treated patients. The participants rated themselves equally as improved with VRE as SE and more so than following the WL, and their satisfaction with treatment ratings were no different for VRE and SE. When allowed to choose which treatment they would receive following WL, the overwhelming majority of participants chose VRE, indicating a clear preference. The gains observed in treatment were maintained at a 6-month follow-up.

There may be advantages to conducting exposure therapy in VR rather than in vivo. Although in this study the time spent in SE and VRE were kept the same, in clinical settings, SE can be very costly because it usually requires leaving the therapist's office and using extended sessions. Many insurance companies will not pay for extended sessions. VRE can accomplish the same exposure within the standard therapy hour (usually 45—50 min) and within the confines of the therapist's office. Many stimuli for SE are expensive and time-consuming to arrange, such as a real airplane at the airport and a flight. SE is bound by real-world limitations; for example, only one take-off and landing per flight. VRE allows the therapist to manipulate situations to best suit the patient, for example, to repeatedly fly the virtual airplane within one session. SE exposes the patient to increased risk and violation of patient confidentiality, whereas VRE maintains the safety and privacy of the therapist's office.

There are obstacles and disadvantages to VR as well. Some patients may not be able to overcome the fact that the exposure is not to the "real" stimulus, and we do not yet have information on what type of person constitutes a good candidate for VR versus in vivo exposure. The obvious goal of therapy is to increase patients' comfort in the real feared environments, so in vivo exposure is always recommended as the end goal. Although the VR does allow the therapist to control some aspects such as take-off, landing, and turbulence, many aspects are not under therapist control. If particular exposures are required that are not already included in the virtual environments, it would be very difficult for the therapist to add these components. The seat does not move, and several users have commented that they miss the G-force and seat positions of a real airplane. Although hydraulic seats exist that would more closely match this experience, they are expensive and temperamental, and it was decided not to include them in this VR setup to keep costs relatively low. Of course, with any computer application, there are occasional computer glitches or difficulties that may interfere with a smooth exposure. The therapist may find treatment difficult or frustrating if a computer glitch occurs, although these have been rare.

In addition, the cost of using VR for exposure therapy may be daunting to some clinicians. The same hardware setup can be used, with the development of additional environment models and software, for the treatment of numerous psychiatric disorders, most notably the anxiety disorders. Many VR environments have multiple applications. For example, a driving application may be used for posttraumatic stress disorder as a result of a motor vehicle accident or fear of driving due to panic disorder, agoraphobia, or specific phobia.

Other limitations to this study include the fact that the posttreatment test flights were conducted in small groups rather than individually. This was done to reduce costs, but is clearly not the manner in which the majority of patients would fly in real life. Also, because of the dearth of standardized measures assessing FOF, the measures, other than the SCID and the Fear of Flying Interview, were based on patients' self-report and were completed by the patient. Although it was well controlled, the completer sample size (45) was small.

The strengths of the current study center on the methodological rigor used. Participants were randomly assigned to treatment condition. Two active treatments were compared, with SE therapy being the current standard in the field and thus the measuring stick for a new treatment. Treatments were well delineated, standardized, brief, and easily replicated. Standard measures were used. Clear eligibility requirements were incorporated, including a *DSM* diagnosis. The same therapist delivered both treatments, thus eliminating potential therapist effects. A major strength of the study was the inclusion of an actual airplane flight following treatment to measure avoidance behavior and in vivo anxiety. Maintenance of treatment gains was measured in follow-up assessments following treatment.

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Table 1. Demographic Characteristics of Sample

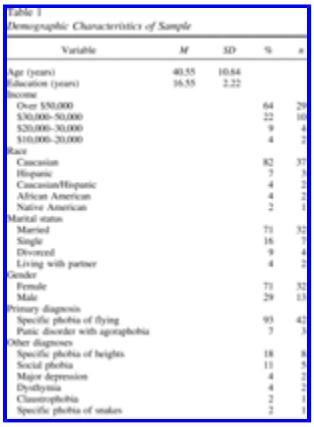

Table 2. Means, Standard Deviations, and One-Way ANOVA Results for Effects of Treatment Type at Pre- and Posttreatment and 6-Month Follow-Up on Fear of Flying

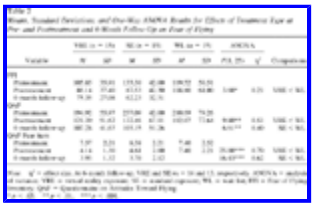

Table 3. Means, Standard Deviations, and One-Way ANOVA for Effects of Treatment Type at Posttreatment and 6-Month Follow-Up on Fear of Flying Measures

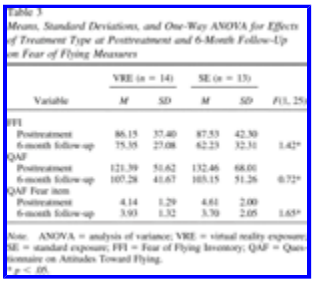

Table 3
Means, Standard Deviations, and One-Way ANOVA for Effects of Treatment Type at Posttreatment and 6-Month Follow-Up on Fear of Flying Measures

	VRE (n = 14)		SE (n = 13)		
Variable	*M*	*SD*	*M*	*SD*	*F*(1, 25)
FFI					
Posttreatment	86.15	37.40	87.53	42.30	
6-month follow-up	75.35	27.08	62.23	32.31	1.42*
QAF					
Posttreatment	121.39	51.62	132.46	68.01	
6-month follow-up	107.28	41.67	103.15	51.26	0.72*
QAF Fear item					
Posttreatment	4.14	1.29	4.61	2.00	
6-month follow-up	3.93	1.32	3.70	2.05	1.65*

Note. ANOVA = analysis of variance; VRE = virtual reality exposure; SE = standard exposure; FFI = Fear of Flying Inventory; QAF = Questionnaire on Attitudes Toward Flying.
*$p < .05$.