

Behavior
Modification

Virtual Reality Versus Computer-Aided Exposure Treatments for Fear of Flying

| | |
|-------------------------------|---|
| Journal: | <i>Behavior Modification</i> |
| Manuscript ID: | BMOD-10-0045.R2 |
| Manuscript Type: | Original Manuscripts |
| Date Submitted by the Author: | n/a |
| Complete List of Authors: | Tortella-Feliu, Miquel; University of the Balearic Islands, University Research Institute on Health Sciences Botella, Cristina; Jaume I University Llabrés, Jordi; University of the Balearic Islands Bretón, Juana; Jaume I University Riera del Amo, Antonio; Jaume I University Baños, Rosa; University of Valencia Gelabert, Joan; University of the Balearic Islands |
| Keywords: | fear of flying, virtual reality, computer-aided, treatment, randomized controlled trial, exposure |
| | |

SCHOLARONE™
Manuscripts

Running Head: VR AND COMPUTER-AIDED EXPOSURE TREATMENTS

Virtual Reality Versus Computer-Aided Exposure Treatments for Fear of Flying

Miquel Tortella-Feliu^{1*}, Cristina Botella^{2,4}, Jordi Llabrés¹, Juana Bretón², Antonio Riera del Amo¹, Rosa M. Baños^{3,4}, and Gelabert, J.M.¹

¹ University of the Balearic Islands, University Research Institute on Health Sciences (IUNICS)

² Jaume I University

³ University of Valencia

⁴ CIBER Fisiopatología Obesidad y Nutricion (CIBEROBN).

* Corresponding author: Miquel Tortella-Feliu. Universitat de les Illes Balears. IUNICS.

Carretera de Valldemossa km.7,5. 07122 Palma (Mallorca, Spain) E-mail:

miquel@ndpc.cat, Phone (+34)971172579, Fax (+34)971173190.

Abstract

Evidence is growing that two modalities of computer-based exposure therapies, virtual reality and computer-aided psychotherapy, are effective in treating anxiety disorders including fear of flying; however, they have not yet been directly compared. The aim of this study was to analyze the efficacy of three computer-based exposure treatments for fear of flying: virtual reality exposure therapy (VRET), computer-aided exposure with a therapist's assistance throughout exposure sessions (CAE-T), and self-administered computer-aided exposure (CAE-SA). Sixty participants with flying phobia were randomly assigned to VRET, CAE-T, or CAE-SA. Results indicate that the three interventions were effective in reducing fear of flying at post-treatment and at one-year follow-up; furthermore, there were no significant differences between them in any of the outcome measure. Large within-group effect sizes were found for all three treatment conditions at both post-treatment and at follow-up. Our results suggest that therapist involvement might be minimized during computer-based treatments, and that CAE can be as effective as VRET in reducing fear of flying.

Keywords: fear of flying, virtual reality, computer-aided, treatment, randomized controlled trial, exposure.

Virtual Reality Versus Computer-Aided Exposure Treatments for Fear of Flying

Introduction

Many computer-assisted treatment procedures have been developed for use in clinical psychology. In parallel, a surge of research in this new field has provided increasing evidence that several kinds of computer-assisted treatment procedures are highly effective in treating anxiety disorders, especially phobic disorders (Cuijpers, Marks, van Straten, Cavanagh, & Andersson, 2009; Krijn, Emmelkamp, Olafsson, & Biemond, 2004; Marks, Cavanagh, & Gega, 2007a; Parsons & Rizzo, 2008; Powers & Emmelkamp, 2008). Depending upon the type of technology used and the main goals for using computers and other electronic devices in psychological treatment, at least two broad categories of computer-assisted treatments have emerged: virtual reality (VR) and computer-aided psychotherapy. We fully recognize, as do other authors (e.g., Marks & Cavanagh, 2009; Marks et al., 2007a) that the distinction between these categories is fuzzy; however, until recently, research on VR and other computer-based psychological treatments has evolved independently as two separate research paths.

Computer-aided psychotherapy, as defined by Marks et al. (2007a) and Marks, Cavanagh, and Gega (2007b) refers to any computing system that aids face-to-face treatment by using patient input to process data and guide treatment decisions, saving therapist time.

VR uses computer-generated environments to simulate stimuli through multiple sensorial channels (mainly visual and auditory), thereby allowing the user to interact with the virtual world while also achieving a sense of being physically there.

1
2
3 The main differences between VR and other computer-based treatments are that
4
5 (a) most of the VR treatments delegate few treatment tasks to the system [with some
6
7 few exceptions like Botella et al.'s (2008) use of VR in a completely self-administered
8
9 internet-based treatment for animal phobia)], as do computer aided-psychotherapy, and
10
11 (b) that VR has been mostly employed as a tool for exposure therapy, called VR
12
13 exposure therapy (VRET), while computer-aided psychotherapy treatments have been
14
15 used to deliver several therapeutic strategies.
16
17
18

19
20 Computer-aided psychotherapy is usually designed to facilitate several routine
21
22 interactive therapy strategies, including education and assessment of current problems
23
24 with feedback and change monitoring, as well as action plans and goals, behavioral
25
26 experiments or systematic exposure, among others. Methods for accessing content
27
28 include standalone or networked personal computers, interactive telephone voice
29
30 response systems, handheld device systems and non-immersive display systems for
31
32 images and sounds (Marks & Cavanagh, 2009; Marks et al., 2007a, 2007b). More than
33
34 one hundred computer-aided psychotherapy systems exist for the treatment of all
35
36 anxiety disorders, and other psychological disorders and health problems (for a
37
38 comprehensive review see Marks et al. 2007a). Computer-aided psychotherapy is as
39
40 effective as face-to-face treatments, at least for anxiety disorders (Cuijpers et al., 2009).
41
42
43
44

45
46 Increasing development and use of computer-aided psychotherapy has relied not
47
48 only in the fact that it saves therapist time by facilitating routine interactive strategies in
49
50 therapy without compromising efficacy (e.g. Marks, Kenwright, McDonough, Wittaker,
51
52 & Mataix-Cols, 2004; McCrone et al., 2007), but also in other multiple benefits.
53
54 Computer-aided treatments increase patients' access to therapy – in face of help
55
56 demands exceeding resources to be supplied by qualified therapists - allow home
57
58 access, ensure confidentiality, reduce patient inhibition and increase his/her motivation
59
60

1
2
3 for treatment, and can quickly report patients' progress. It is also notable that computer-
4
5
6 aided psychotherapy seems to be helpful in clinician training, as well as in refining
7
8
9 process and outcome research in psychotherapy (see Marks & Cavanagh, 2009; Marks
10
11 et al., 2007). As Andersson (2009) stated about internet-based therapy, computer-aided
12
13 psychotherapy is part of the long tradition in cognitive-behavioral therapy of shortening
14
15 treatment without compromising efficacy, mirroring face-to-face treatments, and
16
17
18 facilitating its dissemination and patient access.

19
20 Some computer-aided psychotherapy treatments generally resemble VRET. This
21
22 is the case for direct non-immersive display systems for treating specific phobias and
23
24 other anxiety disorders, which provide a screen display of anxiety provoking cues
25
26 (images and sometimes sounds) in order to conduct systematic exposure. However,
27
28 these kinds of systems do not afford interaction with computer-generated virtual
29
30 environments as VRET does. Focusing on fear of flying, Bornas and colleagues
31
32 developed the Computer-Assisted Fear of Flying Treatment (Bornas, Fullana, Tortella-
33
34 Feliu, Llabrés, & García de la Banda, 2001; Bornas et al., 2001; Bornas et al., 2006), a
35
36 system that provides exposure to photos and accompanying sounds of flying situations
37
38 on a personal computer with a standard screen and headphones. In two controlled trials
39
40 (Bornas et al., 2001, 2006), this computer-assisted exposure (CAE) system was shown
41
42 to be effective in reducing fear of flying, and CAE alone appeared to have some
43
44 advantages in terms of efficiency over other multicomponent programs, suggesting that
45
46 CAE could save time and resources compared to regular face-to-face treatments for fear
47
48 of flying, but it has not yet been tested as a true self-administered treatment.
49
50
51
52

53
54
55 As a psychological treatment, VR has been primarily used to provide systematic
56
57 exposure to anxiety provoking cues by means of immersive computer-generated
58
59 environments, thereby becoming a computer-based alternative to standard in vivo
60

1
2
3 exposure (Powers & Emmelkamp, 2008). Evidence supports that VRET, which
4
5 generally includes cognitive restructuring strategies, is effective at treating anxiety
6
7 disorders, as recently summarized in the meta-analytic studies by Parsons and Rizzo
8
9 (2008), Powers and Emmelkamp (2008) and Wolitzky-Taylor, Horowitz, Powers, and
10
11 Telch (2008) as well as in reviews by Anderson, Jacobs, and Rothbaum (2004), Botella
12
13 et al. (2006) and Krijn et al., (2004) exhibiting effect sizes generally comparable to
14
15 those achieved through in vivo exposure. VRET has been used especially for reducing
16
17 fear of flying, and several controlled trials have tested its efficacy for this phobia (Krijn
18
19 et al., 2007; Maltby, Kirsch, Mayers, & Allen, 2002; Mühlberger, Herrmann,
20
21 Wiedemann, Ellgring, & Pauli, 2001; Mühlberger, Weik, Pauli, & Wiedemann, 2006;
22
23 Mühlberger, Wiedemann, & Pauli, 2003; Rothbaum et al., 2006; Rothbaum, Hodges,
24
25 Smith, Lee, & Price, 2000; Wiederhold & Wiederhold, 2003). In general, these trials
26
27 indicate that VRET provides clear advantages over no treatment conditions in reducing
28
29 fear of flying, and it is at least as effective as in vivo exposure. Additionally, VRET has
30
31 proven to be effective in open trials including those conducted with the “Virtual Flight”
32
33 environment used in the present study (Baños et al., 2002; Botella, Osma, García-
34
35 Palacios, Quero, & Baños, 2004). Beyond efficacy criteria, VRET has a number of
36
37 advantages over other kinds of exposure treatments, some of which are shared with
38
39 computer-aided psychotherapy, including confidentiality, patient’s perceived security
40
41 during sessions, higher levels of control of the exposure conditions, and the ability to be
42
43 fully conducted in a therapist’s office.
44
45
46
47
48
49
50
51

52
53 Computer-based treatment systems have a variety of potential problems to be
54
55 addressed. These include three closely inter-related features: patient attitudes and
56
57 expectations towards treatment, attrition rates, and the guidance and support therapists
58
59 must provide to patients (e.g., Andersson, 2009). Some of these problems are more
60

1
2
3 related to clinicians' concerns than with facts. For instance, professional expectations
4
5 are that patients will find face-to-face therapies more acceptable than computer-aided
6
7 ones (Whitfield & Williams, 2004). However, evidence from multiple studies suggests
8
9 that patients' satisfaction, preferences, and acceptability of computer-aided
10
11 psychotherapy treatments are high and quite similar to their evaluations of face-to-face
12
13 interventions (e.g., Cavanagh et al., 2009; Graham, Franses, Kenwright, & Marks, 2000;
14
15 Kaltenthaler, Parry, & Beverley, 2004; Marks, Kenwright, McDonough, Whittaker, &
16
17 Mataix-Cols, 2004). The same is true for VRET (e.g., Mühlberger et al., 2006;
18
19 Rothbaum et al., 2006). However, other studies do report greater patient satisfaction for
20
21 face-to-face interventions (e.g., Bowers et al., 1993). This deserves attention because a
22
23 higher credibility of computer-based treatment appears to be related to better treatment
24
25 outcomes than other factors like severity of fear of flying or the severity of overall
26
27 psychopathology (Mühlberger et al., 2006). Furthermore, in computer-aided
28
29 psychotherapy research, data clearly indicate that, as in any kind of treatment, less
30
31 satisfaction is associated with greater attrition (Marks et al., 2007a). In general, it can be
32
33 stated that drop-out rates do not differ across computer-aided psychotherapy and face-
34
35 to-face care (Cuijpers et al., 2009) and, once again, the same occurs in VRET (Krijn et
36
37 al., 2004).

38
39
40
41
42
43
44
45
46 Regarding therapist support, research indicates that although computer-based
47
48 treatments cannot totally replace human interaction, they can reduce face-to-face time.
49
50 A number of meta-analytic studies have found that computer-aided treatment effects are
51
52 smaller when patients had less therapist time (Cuijpers et al., 2009; Palmqvist,
53
54 Carlbring, & Andersson, 2008). This is an important challenge for computer-based
55
56 treatments and establishing the best methods for their self-administration. Currently, it
57
58 is widely recognized that some personal support increases adherence to computer-aided
59
60

1
2
3 psychotherapy, although it can increase costs; furthermore, the best types, frequency,
4 duration and sites of clinician support have not yet well established (Andersson, 2009;
5 Marks et al., 2007a). As described below, in the present study different kinds of
6 computer-based treatments with differing degrees of therapist involvement were
7 delivered; they were then compared in terms of patients' treatment expectations,
8 satisfaction, and adherence.
9

10
11
12
13
14
15
16
17 The aim of this study was to compare efficacy of three computer-assisted
18 exposure-based treatments for fear of flying: (a) virtual reality exposure assisted by a
19 therapist supporting the patients throughout the therapy process and using cognitive
20 strategies to challenge dysfunctional beliefs associated with fear of flying (VRET); (b)
21 computer-aided exposure with a therapist present throughout the exposure sessions but
22 only solving the possible doubts that could appear using the system and not directly
23 involved in the therapeutic process (CAE-T); and (c) a totally self-administered
24 computer-aided exposure (CAE-SA). The study builds on the advances in research on
25 VR and computer-aided psychotherapy, as described in previous works (Botella et al.,
26 2007; Botella et al., 2008).
27
28
29
30
31
32
33
34
35
36
37
38
39
40

41 To our knowledge, no previous studies have directly compared VRET and CAE,
42 though other trials have shown that the treatment outcomes for both interventions for
43 flying phobia are quite similar (Bornas et al., 2006). However, a direct comparison is
44 required; specially because the procedures differ in the kind of therapist involvement
45 required and in the cost of devices used. Along these lines, this study could shed light
46 on such topics as therapist involvement and, indirectly, cost-effectiveness. We also
47 compared application of CAE with continuous therapist contact with a self-administered
48 version in order to determine whether therapist involvement can be decreased during
49 computer-based treatments without compromising efficacy.
50
51
52
53
54
55
56
57
58
59
60

1
2
3 The study was based on the following hypotheses: (a) VRET and both of the
4 CAE treatments would significantly reduce fear of flying before versus after the
5 treatments, and that these gains would be largely maintained at follow-up; (b) results
6 from applying the three treatment conditions would not differ significantly regarding
7 the reduction of fear of flying and flying behavior both at post-treatment and at follow-
8 up; and, (c) the highest attrition rates would be found in the self-administered
9 procedure. The study also examined users' expectations and satisfaction with the
10 various treatments, a topic on which the literature is not conclusive. The expectation
11 was that (d) participants in the VRET condition would rank their treatment as being
12 more valuable than that of the users of the CAE conditions, both at pretreatment and
13 after treatment (since therapist involvement is substantially greater in VRET).
14 Expectations and satisfaction were expected to be high for all three conditions.
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

32 Method

33 *Participants*

34 Eighty-six individuals requested treatment; they were then screened for the
35 study. Participants were recruited from the community through advertisements in local
36 newspapers, flyers posted in our research centers and on the research group's website.
37 Sixty participants met the criteria for the study and were randomly assigned to one of
38 the three treatment conditions.
39
40
41
42
43
44
45
46
47

48 In order to be included in the trial, each participant had to meet current DSM-IV
49 criteria for specific phobia (situational, related to fear of flying). Exclusion criteria
50 included: people younger than 18, current psychological treatment, psychotropic
51 medication use, any other current psychopathological disorder requiring immediate
52 treatment, mental retardation, cardiovascular or respiratory illness, and current
53 pregnancy. Twenty-six subjects were excluded from the study after the initial screening.
54
55
56
57
58
59
60

1
2
3 Reasons for exclusion included fear of flying that does not meet criteria for specific
4 phobia (n=1), taking anxiolytic or antidepressive medication (n=12), other axis I main
5 diagnoses (panic disorder, major depressive disorder) (n=7), chronic organic diseases
6 (n=2), developmental disabilities (n=1), being under 18 years old (n=2) and pregnancy
7 (n=1).
8
9

10
11
12 Demographic information, baseline scores on primary outcome measures, and
13 time avoiding flying of enrolled participants are depicted in Table 1. None of them have
14 previously received psychological treatment for fear of flying.
15
16

17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Insert table 1 about here

Measures

Diagnostic Status and Fear of Flying Features. The Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994) was used at pretreatment and at post treatment to determine diagnostic status and to quantify levels of fear, avoidance, and interference on a scale of 0 to 8 (0 = no fear, avoidance or interference, 8 = extreme fear, avoidance or interference). Specifically, the section on specific phobias of the Anxiety Disorders Interview Schedule for DMS-IV was used. ADIS-IV is an excellent interview for assessing anxiety disorders; it has proven adequate psychometric properties according to Anthony, Orsillo, and Roemer (2001).

Self-reported fear of flying. The *Fear of Flying Questionnaire* (FFQ; Bornas, Tortella-Feliu, García de la Banda, Fullana, & Llabrés, 1999) and the *Fear of Flying Scale* (FFS; Haug et al., 1987) were used to assess self-reported of fear of flying. The FFQ is a 30-item self-report instrument describing situations related to flying: anxiety during flight, anxiety experienced getting on the plane, and anxiety experienced by the

1
2
3 observation of neutral or unpleasant flying-related situations. For each item,
4
5 respondents rated their degree of discomfort associated with the situation on a scale of 1
6
7 to 9 (1 = not at all, 9 = very much). Scores ranged from 30 to 270. As reported by
8
9 Bornas et al. (1999), internal consistency was $\alpha = .97$ and retest reliability (15-day
10
11 retest period) was $r = .92$. In our sample, Cronbach's alpha for the FFQ was .90.
12
13

14
15 The FFS consists of 21 items describing air travel situations. Fear elicited by
16
17 each situation was rated on a five-point scale (0 = not at all, 4 = very much), with scores
18
19 ranging from 0 to 84. In the original FFS (Haug et al., 1987) Cronbach's α was .94 and
20
21 retest reliability (at three months) was $r = .86$. For the translated version used in this
22
23 study, Cronbach's α and 15-day retest reliability were .95 ($n = 228$) and .86 ($n = 106$)
24
25 respectively (unpublished results). In our sample, Cronbrach's alpha for the FFS was
26
27 .88.
28
29
30

31
32 *Clinician ratings.* At the end of individual interviews, independent assessors
33
34 rated, both at baseline and at post-treatment, the severity of the patients' phobias on a
35
36 scale from 0 to 8, where 0 = symptom free and 8 = extremely severe and disabling, for
37
38 all aspects of life affected. This scale was the same as that used by Öst, Stridh, and
39
40 Wold (1998). At the end of the interview the clinician rated the severity of the patient's
41
42 phobia on a 0-8 scale
43
44

45
46 *Treatment expectations and satisfaction.* Treatment expectations and satisfaction
47
48 were measured after the treatment was presented in the first session, and also at post-
49
50 treatment and at follow-up, using an adaptation of the Borkovec and Nau (1972)
51
52 "Credibility/Expectation Scales". Several aspects were quantified, including: credibility
53
54 ("To what extent does the treatment seem logical to you?"), usefulness ("To what extent
55
56 do you think that the treatment is or was useful in your case?"), satisfaction ("To what
57
58 extent are you satisfied with treatment (to be received or received)?") and treatment
59
60

1
2
3 aversion (“To what extent is or was the treatment aversive for you?”). Questions were
4
5 answered on a scale of 0 to 10 (0 = not at all, 10 = maximum). This instrument has
6
7 demonstrated good factorial structure, internal consistency and reliability according to
8
9 Devilly and Borkovec (2000).
10
11

12 *Procedure*

13
14 All individuals who requested treatment were screened through a personal
15
16 interview to determine their diagnostic status and to quantify the degree of fear,
17
18 avoidance, and interference associated with their fear of flying. Also, fear of flying
19
20 questionnaires (FFS and FFQ) were administered in the same session. All of the
21
22 assessments were carried out by independent evaluators who were not involved in the
23
24 randomization process. At the end of the screening, assessors rated their impressions on
25
26 the severity of fear of flying. Suitable candidates for treatment (n = 60) were
27
28 randomized to one of three treatment conditions: computer-aided exposure treatment
29
30 assisted by a therapist (CAE-T) (n=20), self-administered computer-aided exposure
31
32 (CAE-SA) (n=21) and virtual reality exposure treatment (VRET) (n=19). To control for
33
34 procedural fidelity, detailed session-by-session therapist manuals were used. All of the
35
36 eligible patients accepted treatment and signed an informed consent form.
37
38
39
40
41
42

43 *Treatments and Apparatus*

44
45 In the first session, for all three treatment conditions, we presented a 30 minute
46
47 explanation of the mechanism contributing to the origin and maintenance of fear of
48
49 flying; the rationale and structure of treatment were also provided. The goal was to
50
51 briefly explain the following concepts: the role of avoidance in maintaining a phobia,
52
53 other manifestations of phobic disorders (psychophysiological responses and cognitive
54
55 concomitants), which is its prevalence, factors associated to the onset of fear of flying,
56
57 the definition of exposure therapy, and methods for planning graded exposure using
58
59
60

1
2
3 computer-based programs. This explanation was identical for all three experimental
4
5 conditions, differing only in how the computer-based programs (VRET or CAE) work
6
7 and how they would be used. A five-page booklet with explanations of fear of flying
8
9 and treatment rationale was given to all participants. Before beginning exposure, the
10
11 patients were familiarized with the computer programs and devices. Then, patients were
12
13 asked about their satisfaction with the treatment rationale, with receiving the treatment,
14
15 and their expectations for possible treatment results. Finally, exposure was conducted in
16
17 the initial session under the unique conditions for each treatment.
18
19
20
21

22 *VRET*. The Virtual Flight software was used to provide exposure to three virtual
23
24 scenarios: packing at home, waiting for boarding at the airport terminal, and sitting in
25
26 the airplane while taking off and during flight. A detailed description of the virtual
27
28 environments can be found in Botella et al. (2004). The software includes three VR
29
30 scenarios: the room, the airport, and the plane.
31
32
33

34 The room is a scenario designed to address anticipatory anxiety. The patient is in a
35
36 bedroom and he/she can perform some activities usually associated with the days or
37
38 hours before a flight: packing, listening to news regarding air traffic and weather
39
40 conditions. In the airport scenario the patient can listen to flight announcements and see
41
42 them on the board, knowing that his/her flight is approaching; he/she can listen to
43
44 people talking about flying; it is also possible to see and hear planes taking off and
45
46 landing; finally the patient can arrive at the gate, and enter the plane. In the plane
47
48 scenario, the patient is seated close to the window and can listen to the radio or read a
49
50 magazine while waiting for the plane to start its engines. The flight process includes
51
52 watching the safety demonstration, hearing the captain welcoming the passengers, take-
53
54 off and flight (in which the therapist can change the weather conditions, generate
55
56 thunder, lightning, and turbulence), and landing.
57
58
59
60

1
2
3 During exposure, the participant sat on a standard office chair and wore a 5DT
4
5 HDM 800 immersive head mounted display attached to a personal computer (Intel Core
6
7 2 Duo E6850, 3 GHz, 2MB RAM; graphic engine ASUS Extreme AX300SE/T 128
8
9 MB). The virtual reality equipment was operated by the therapist.
10
11

12 The main component of the treatment was VR exposure that included some kind
13
14 of cognitive restructuring. Except for the first session (as described in the Procedure
15
16 section), the following sessions were devoted to virtual exposure to the different
17
18 scenarios, progressing from the easiest to the most difficult situations (according to the
19
20 participant hierarchy established by the therapist with the patient in the first session
21
22 along with data from the pretreatment assessment). The main goal of each exposure was
23
24 for the patient to remain in the situation until a significant decrease in subjective anxiety
25
26 was achieved. Therapists attended all VRET sessions, applying the VRET system and
27
28 guiding the use of cognitive strategies. Every five minutes the therapists asked the
29
30 patients to rate their anxiety levels and to verbalize the catastrophic thoughts and
31
32 feelings experienced during exposure. The therapists challenged the dysfunctional
33
34 beliefs associated with fear of flying. Patients did not receive homework, and practicing
35
36 in vivo between sessions was not encouraged.
37
38
39
40
41
42

43 *CAE-T.* CAE was conducted with CAFFT2 online software displayed on a
44
45 personal computer (Pentium IV 2.80GHz 512 MB RAM) connected to the Internet and
46
47 with a 17-inch screen (graphic engine radeon 7000AGP 64MB). The CAFFT2
48
49 automatically configured a display of photos and associated sounds according to the
50
51 patient's fear hierarchy for flight-related situations (drawn from answers to the Fear of
52
53 Flying Questionnaire). Six sequences from 1 minute 51 seconds to 2 minutes 49
54
55 seconds were included: buying a ticket, packing at home, going to the airport and
56
57 boarding, taking off, flying, landing, and hearing news about an aircraft accident. At the
58
59
60

1
2
3 end of each sequence, the program requested fear ratings; based on the replies, the
4
5 exposure continued with the same sequence or proceeded to the next sequence in the
6
7 hierarchy. The CAFFT2 has been fully described elsewhere (Bornas et al., 2001; Bornas
8
9 et al., 2006; Bornas et al., 2002). Therapists attended all CAE-T sessions, although they
10
11 were instructed not to intervene unless technical problems occurred. If patients asked
12
13 about the treatment process, they were invited to utilize the program's online help
14
15 system.
16
17
18

19
20 *CAE-SA*. The CAE was also conducted with CAFFT2 online as described for
21
22 the CAE-T group. However, the CAE-SA treatment was essentially self-administered;
23
24 face-to-face therapist support was available only during the first and last sessions. At
25
26 the first session, the information and instructions for using the computer program were
27
28 the same as for CAE-T; however, they also informed the patients that they would
29
30 undergo exposure alone with the computer. Additionally, they learned that their
31
32 progress would be monitored; the online computer system allowed the therapist to know
33
34 when the patient accessed the program, the duration of the sessions, the number of
35
36 exposure trials completed, discomfort rates after each exposure, and so on. A telephone
37
38 number was provided for contacting the therapist during the exposure sessions in case
39
40 problems occurred with the computer or with the procedure. The therapists and users
41
42 scheduled five additional days for one-hour exposure sessions with the computer in the
43
44 university clinic. The first exposure trials were begun with a therapist present, to make
45
46 sure the patients had completely understood the instructions. Then, the therapist left the
47
48 clinic while the user was exposed to images and sounds. In the following sessions the
49
50 user simply asked the receptionist for access to the session room. At the last session,
51
52 each patient had a personal 20 minute meeting with a therapist. Because the therapists
53
54 tracked the patients' progress, they could predict on which day the treatment would
55
56
57
58
59
60

1
2
3 likely end. The meetings at the conclusion of the last session were designed to review
4
5 how the treatment worked and to encourage the patients to take a real flight on their
6
7 own in the following 15 days. Patients also answered two self-report measures on fear
8
9 of flying.
10
11

12 For each treatment, a maximum of six one-hour, twice-weekly sessions was
13
14 established. However, participants could terminate treatment before the sixth session if
15
16 they completed all of the treatment modules. All treatments were conducted in the
17
18 University Clinic Laboratories. All individuals who started treatment paid 90 Euros. At
19
20 the conclusion of the treatments, patients were encouraged to take a flight on their own
21
22 without any therapeutic help in the following 15 days. In the last session, patients
23
24 completed fear of flying questionnaires and scheduled an interview for approximately
25
26 15 days later. Posttreatment and one-year follow-up interviews were conducted
27
28 (independent of whether the patient had flown or not) by an independent assessor
29
30 unaware of the participants' treatment conditions, to determine the diagnostic status, the
31
32 present degree of fear, avoidance, and interference associated with fear of flying and the
33
34 external rating of severity. They also asked at posttreatment and at one-year follow-up
35
36 about participants' satisfaction with the treatment they received.
37
38
39
40
41
42

43 *Statistical analyses*

44
45 Analyses included an intent-to-treat (ITT) using the LVCF (last value carried
46
47 forward) method. Missing values at post-treatment and/or at one-year follow-up were
48
49 imputed with the participant's pretreatment score. This method was selected to
50
51 minimize any potential inflation of post treatment results. In some cases, data were
52
53 reported only for participants who completed treatment. To assess treatment effects, all
54
55 outcome measures with continuous data were analyzed with mixed analyses of variance
56
57 (general linear model), with *group* as the between-subject factor (CAE-T, CAE-S,
58
59
60

1
2
3 VRET) and *time* as the within-subject factor (pretreatment, posttreatment, one-year
4 follow-up). The within-group effect sizes of change were analyzed within and groups
5 using Cohen's *d* (Hedges corrected).
6
7

8
9
10 The Mann-Whitney *U* test was used to determine possible differences among
11 participants who dropped out or did not attend the posttreatment and/or follow-up
12 assessments and those who finished treatment and attended all assessment sessions. At
13 baseline, treatment groups were compared through one-way analyses of variance or chi-
14 square tests, to determine if randomization was successful and to explore possible
15 differences in treatment credibility or expectations.
16
17
18
19
20
21
22
23

24
25 Chi-square tests were performed to evaluate group differences for participants
26 taking an actual flight after treatment and during the follow-up period, clinically
27 significant improvement rates based on Jacobson and Truax (1991) indexes for FFQ
28 scores, and number of participants free of specific phobia diagnosis related to fear of
29 flying both at posttreatment and at one-year follow-up.
30
31
32
33
34
35

36 Results

37 38 *Equivalence of groups*

39
40
41 As depicted in Table 1, no significant differences were found before treatment
42 among participants in the three treatment conditions, socio-demographic variables, or
43 fear of flying measures. It can thus be concluded that randomization was successful.
44
45
46
47

48 *Attrition*

49
50 One participant withdrew from each of the following groups: CAE-T (5%) and
51 VRET (5.26%). Both alleged scheduling problems after not attending scheduled
52 sessions. Two participants withdrew from CAE-SA (9.5%); one also reported
53 scheduling conflicts after not attending a session and the other one felt ill after treatment
54
55
56
57
58
59
60

1
2
3 began. No significant differences were found among treatment conditions in attrition
4
5 rates ($\chi^2(2) = 0.425, p = .809$).

6
7
8 Participants who dropped out did not differ from participants who completed the
9
10 treatment in any pretreatment variable except for treatment expectations ($p = .017$);
11
12 those who withdrew scored significantly lower ($M=4.50, SD 3.00, U$ Mann-Whitney
13
14 mean rank 11.12) than those who completed the sessions ($M=7.89, SD 1.41$) (U Mann-
15
16 Whitney mean rank 31.88).

17
18
19 Three participants who completed treatment, one per intervention group, did not
20
21 attend the two week posttreatment assessment session. They did not differ from
22
23 participants attending the 15-day posttreatment assessment in any of the measured
24
25 variables.
26
27

28
29 At one-year follow-up, 38 participants attended the assessment session (63.33%
30
31 of those who started treatment, 71.70% of those who finished treatment and completed
32
33 posttreatment assessment). No significant differences were found among treatment
34
35 conditions at one-year follow-up attendance ($\chi^2(2) = 0.730, p = .694$). The fifteen
36
37 participants who did not attend follow-up did not differ from those who did in any of
38
39 the posttreatment variables except for avoidance as measured by ADIS-IV; those who
40
41 did not attend follow-up assessment scored significantly higher ($M=3.93, SD 3.08$) than
42
43 those who did ($M=2.03, SD 2.65$) ($t(51)=2.26, p=.028$).

44
45
46
47
48 *Treatment effects on self-reported fear of flying, interview and clinicians' ratings.*

49
50 As depicted in Table 2, results of an intent-to-treat analysis (last value carried
51
52 forward method) indicate that time main effects were significant for all fear of flying
53
54 self-report measures, main ratings in ADIS-IV, and in clinicians' ratings on the severity
55
56 of the patients' phobia, revealing overall treatment effect. Contrasts show a significant
57
58 reduction from pretreatment to posttreatment and from pretreatment to one-year follow-
59
60

1
2
3 up in all of the fear of flying variables. From posttreatment to one-year follow-up,
4
5 decreases in self-reported fear of flying remained stable, whereas fear, avoidance, and
6
7 interference ratings in the ADIS-IV as well as clinicians' ratings on the severity of the
8
9 patients' phobia worsened. However, reductions from pretreatment to one-year follow-
10
11 up are clearly statistically and clinically significant, as shown in the pairwise
12
13 comparisons and standardized effect sizes reported in Table 2.
14
15
16
17
18
19

20 Insert table 2 about here
21
22
23
24

25 Treatment x group interaction effects were not significant for any variables,
26
27 indicating no different treatment effects. Likewise, group main effects were not
28
29 significant for any of the dependent variables; that is, treatment groups did not differ
30
31 significantly from each other. All three conditions exhibited significant effects for all
32
33 outcome measures from both pretreatment to posttreatment and from pretreatment to
34
35 one-year follow up.
36
37

38 *Clinically meaningful improvement and diagnostic status at posttreatment*

39
40

41 Clinically meaningful improvement was calculated for FFQ scores using the
42
43 Jacobson and Truax's (1991) indexes. As shown in Table 3, both at posttreatment and at
44
45 follow-up, most of the participants fell into the category of "recovered" or "improved"
46
47 regardless of their treatment conditions, with no statistically significant differences
48
49 among treatments; this is true both for the completers' and for the ITT analyses.
50
51
52
53
54

55 Insert table 3 about here
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Posttreatment interviews revealed that the majority of participants were specific phobia (situational) diagnosis-free (Table 3) with no differences among groups for diagnostic status. At one-year follow-up, the groups did not differ regarding diagnostic status for each condition. However, percentage of phobia-free participants in all three treatment groups decreased to 50% at the one-year assessment.

Behavioral outcomes

At the end of treatment, participants were encouraged to take a real flight on their own as soon as possible. Two weeks after the last treatment session, they were contacted to determine if they had done so, and to schedule the posttreatment interview. During this 15-day period, 10 out of 18 participants who had completed treatment in the CAE-T group flew (50% of CAE-T participants), compared to 13 out of 18 in the CAE-SA group (61.9% of CAE-SA participants), and 15 out of 17 in the VRET group (78.9% of VRET participants). No differences were found among groups nor among those who had completed treatment ($\chi^2(2) = 4.60, p = .100$) nor in the ITT analysis ($\chi^2(2) = 3.54, p = .170$).

From posttreatment to the one-year follow-up assessment, 9 out of 14 participants in the CAE-T group who attended the assessment sessions flew (45% of CAE-T participants enrolled in this group; number of flights $M = 3.43, sd = 6.34$), compared to 8 out of 12 both in the CAE-SA group (38.1% of those who started treatment) and in the VRET group (36.8% of those who started treatment). The mean number of flights taken by CAE-SA participants was $M = 2.73, sd = 3.61$, and the mean was $M = 1.83, sd = 1.80$ for VRET participants. No differences in taking or not taking a flight were found among groups, nor among those who attended follow-up ($\chi^2(2) = 0.22, p = .989$) nor in the ITT analysis ($\chi^2(2) = 0.69, p = .708$). Groups did not differ statistically in the number of flights taken ($F(2, 36) = 0.406, p = .670$).

1
2
3 *Treatment features and treatment satisfaction ratings.*
4

5
6 As stated in the Procedure section, all treatments comprised a maximum of six
7
8 one-hour, twice-weekly sessions. Despite pre-established length of the treatments, an
9
10 individual participant's treatment could be shortened if the participants completed the
11
12 last exposure sequence in their own hierarchy before the sixth session. Indeed, some
13
14 participants achieved this. The mean number of sessions for each treatment was $M =$
15
16 4.70 (SD 1.34) in the CAE-T, $M = 4.10$ (SD 1.51) in the CAE-SA, and $M = 5.32$ (SD
17
18 1.42) in the VRET. One-way ANOVA revealed statistically significant differences
19
20 among groups ($F[2] = 3.65$, $p = .032$). Post-hoc analyses indicated that the CAE-SA
21
22 group differed significantly from the VRET group ($t[1] = 2.70$, $p = .032$), but did not
23
24 differ significantly from the CAE-T group ($p = .405$); the same was true for the CAE-T
25
26 group as compared to the VRET group ($p = .410$).
27
28
29
30

31
32 As described in the Procedure section, after the treatment to be used was
33
34 presented during the first treatment session, patients were asked (with each question
35
36 rated on a scale of 0 to 10) about treatment credibility, satisfaction with receiving the
37
38 treatment, expectations for possible treatment results (usefulness), and expected
39
40 aversiveness of the treatment. Participants in all three conditions generally evaluated
41
42 treatments as logical, satisfactory, useful and not very aversive. Treatment groups
43
44 differed in the credibility granted to their respective interventions. Multiple
45
46 comparisons revealed significant differences between the VRET and CAE-SA groups
47
48 ($F = 3.12$; $p = .011$), while there were no differences between the VRET and CAE-T
49
50 groups and CAE-T and CAE-SA groups. A similar though not statistically significant
51
52 tendency was observed for expectations for treatment results (usefulness and
53
54 satisfaction).
55
56
57
58
59
60

1
2
3 At the end of treatment and at follow-up, participants were again asked for their
4
5 opinions on the treatment rationale (treatment credibility), satisfaction with the
6
7 treatment, the treatment usefulness in their particular cases, and whether the treatment
8
9 had been aversive. At the end of treatment, participants in all three conditions generally
10
11 evaluated treatments as very logical (credible), satisfactory, useful, and not very
12
13 aversive. Virtual reality was, in all cases, the preferred treatment. Statistically
14
15 significant differences among groups were found in approval of the treatment rationale,
16
17 and in satisfaction with treatment. Multiple comparisons revealed that participants in the
18
19 VRET group approved of the treatment rationale more than participants in the CAE-SA
20
21 group ($F = 2.99, p = .016$). No statistically significant differences were found between
22
23 the VRET and CAE-T groups, nor between the CAE-T and CAE-SA groups for this
24
25 variable. Multiple comparisons also showed that participants in the VRET group were
26
27 more satisfied with treatment than those in the CAE-T ($F = 2.53, p = .049$) and CAE-
28
29 SA ($F = 4.31, p = .0001$) groups. The CAE-SA and CAE-T groups did not differ
30
31 significantly in any of these participant ratings. No statistically significant differences
32
33 emerged among groups in evaluations of treatment usefulness or aversive aspects of the
34
35 interventions.
36
37
38
39
40
41
42

43 At one-year follow-up, previous differences among groups for expectations or
44
45 satisfaction with treatment completely disappeared, and no differences were found
46
47 among groups for any of these variables.
48
49
50
51
52

53 Discussion

54
55 To the best of our knowledge, this is the first study comparing VRET with other
56
57 forms of computer-based treatment. In this trial, VRET was compared with computer-
58
59 aided exposure treatment as assisted by a therapist or self-administered. As
60

1
2
3 hypothesized, all three treatment conditions were equally effective at significantly
4
5 reducing fear of flying statistically and clinically, both at post-treatment and at one-year
6
7 follow-up, as measured by the following: self-reported fear, number of participants
8
9 taking a flight on their own during a 15-day period after treatment and during the
10
11 following year, fear ratings, degree of avoidance and interference in the ADIS-IV
12
13 interview, severity as assessed by independent assessors' ratings, and number of
14
15 participants becoming free of diagnosis for specific phobia (situational). Nevertheless, it
16
17 must be noted that reductions in fear at post-treatment were not fully maintained at one-
18
19 year follow-up. After one year, ADIS-IV main ratings (for fear, avoidance, and
20
21 interference), and clinical ratings for global severity, excluding self-reported fear of
22
23 flying measure worsened significantly; however, they remained significantly lower than
24
25 pretreatment ratings.
26
27
28
29
30

31
32 As expected, large within-group effect sizes were found for all three treatment
33
34 conditions from pretreatment to post-treatment, comparable to those reported in
35
36 previous studies for VRET (Parsons & Rizzo, 2008). At one-year follow-up, within-
37
38 group effect sizes remained large for all treatment conditions, though smaller than at
39
40 post-treatment.
41
42

43
44 Neither at post-treatment nor at follow-up were there statistically significant
45
46 differences among treatment conditions in clinically meaningful improvement,
47
48 diagnostic status, or behavioral outcomes (including taking or not taking a flight and
49
50 number of flights taken). Most participants were categorized as "recovered" or
51
52 "improved" at both assessment times. Regarding diagnostic status, most patients were
53
54 specific phobia (situational) diagnosis-free at post-treatment; however, at one-year
55
56 follow-up there was a decline in the number of participants without a specific phobia
57
58 (situational) diagnosis. Just as most of the participants in all groups had taken a flight on
59
60

1
2
3 their own at post-treatment, most participants who attended one-year follow-up also
4
5 flew during the following year.
6
7

8 Contrary to our third hypothesis (that the highest attrition rates would be found
9
10 in the self-administered procedure), no greater attrition was observed in the CAE-SA
11
12 group than in the other two treatment conditions; furthermore, no single participant
13
14 refused treatment. Marks and Cavanagh (2009) posited that perhaps only a few minutes
15
16 of formal contact with a therapist might be sufficient to prevent discontinuation.
17
18 Sufficient confidence in the program was perhaps ensured through some or all of the
19
20 following measures: personal initial and final session meetings, the availability of phone
21
22 and e-mail contact with therapists (though this was not used by any patient), and
23
24 informing participants that their progress in the CAE was tracked through online data
25
26 that was relayed to a therapist.
27
28
29
30

31 The last aim of our study was to analyze users' expectations and satisfaction
32
33 with the various treatments. This is a controversial topic on which the literature is not
34
35 conclusive (e.g., Whitfield & Williams, 2004; Cavanagh et al., 2009). We hypothesized
36
37 that expectations and satisfaction would be high for all three treatment conditions. In the
38
39 fourth hypothesis we stated that because therapist involvement is substantially greater in
40
41 the VRET treatment condition, participants in that group would rank their treatment as
42
43 more valuable than users of the CAE conditions. Our results yielded the following
44
45 conclusions. First, both expectations at pretreatment and satisfaction were high for all
46
47 treatment conditions, although they decreased at one-year follow-up. This is probably
48
49 related to the reduced gains from post-treatment to follow-up. Second, as hypothesized,
50
51 participants in VRET condition had greater expectations for treatment before starting it,
52
53 mainly in terms of credibility, and they were also more satisfied with the intervention at
54
55
56
57
58
59
60

1
2
3 post-treatment compared to the CAE groups. However, these differences disappeared at
4
5 follow-up; groups did not diverge in any of these variables.
6
7

8 Our results raise some interesting questions to be further explored. This is not
9
10 the first study indicating that treatment effects are not enhanced by enriching computer-
11
12 generated exposure environments to appear more realistic. Mühlberger et al. (2003)
13
14 showed that adding motion and vibration simulations did not further enhance the
15
16 treatment effects of VRET for visual and acoustic stimuli. Development of CAFFT2
17
18 also demonstrated that more sophisticated immersive conditions (such as darkness and
19
20 projecting large screen images) did not produce better results than exposure to images
21
22 and sounds on a standard PC screen in a lighted room (Bornas et al., 2001; Bornas et al.,
23
24 2006). These data suggest that less sophisticated and cheaper devices might be
25
26 sufficient for producing satisfactory outcomes, at least in some cases. Furthermore,
27
28 these results emphasize the need for further investigation into the processes that can
29
30 provoke the subjective sensation of “being there” in the mediated environment, as well
31
32 as the role of this sense of “presence” in therapeutic efficacy. Interestingly, it may be
33
34 that the similar outcomes for VRET and CAE in our study can be partially attributed to
35
36 the critical role of sound in evoking anxiety in patients who exhibit fear of flying
37
38 (Bornas et al., 2004). Sound might be more relevant than the visual cues that are
39
40 addressed by other immersive conditions or the interaction provided by virtual reality.
41
42 In other words, equivalence of virtual reality and other computer-aided systems for
43
44 providing successful exposure treatment for fear of flying may not be generalizable to
45
46 different anxiety disorders where visual cues are more significant than auditory ones.
47
48 It is interesting to note that the computer-aided exposure treatments with minimal
49
50 therapist participation (mainly in the self-administered condition) obtained equivalent
51
52 outcomes as VRET, despite the fact that VRET was applied with a therapist playing a
53
54
55
56
57
58
59
60

1
2
3 central role (elaborating the hierarchy, controlling the computer inputs and especially by
4
5 applying some cognitive strategies). This has obvious efficiency implications, as does
6
7 the fact that CAE treatments were completed in fewer sessions than VRET. That is, if
8
9 our results are replicated, in a stepped care model, self-administered CAE treatments for
10
11 fear of flying could be recommended before opting for more costly procedures that
12
13 require greater therapist involvement such as VRET or CAE which require continuous
14
15 therapist assistance.
16
17
18

19
20 Another feature of the study worthy of additional attention is to determine the
21
22 true weight of cognitive strategies in VRET. In the present trial, the use of cognitive
23
24 strategies was minimal compared to other VRET studies wherein some sessions are
25
26 devoted specifically to cognitive issues. However, there was no “pure exposure” with
27
28 any cognitive component, as there was in both CAE groups. Krijn et al. (2007) partially
29
30 concluded from the results of their study that because VRET (as the sole component of
31
32 intervention) was not sufficiently effective at reducing fear of flying, perhaps a
33
34 combination of techniques (e.g. cognitive restructuring) was necessary. They state the
35
36 need for future research on direct comparison of VRET and VRET plus cognitive
37
38 techniques.
39
40
41
42

43
44 We agree that this is necessary, but for a different reason. Our belief is that
45
46 therapist-guided cognitive restructuring is not in fact central to exposure treatment
47
48 effects, as the results obtained in this study of CAE treatments suggest. This alternative
49
50 hypothesis would lead us to believe that it is possible to design new VR programs in the
51
52 form of navigable scenarios which would enable self-administration of VRET for fear
53
54 of flying (with or without formal and therapist-guided cognitive restructuring). This
55
56 technological development could enable the dissemination of VR systems to
57
58 interventions without requiring continuous personal therapist support, thus saving
59
60

1
2
3 therapist time. This is not to imply that the role of the therapist is insignificant, nor that
4
5 cognitive strategies are useless; rather, the point is that VRET can perhaps be
6
7 administered with less therapist involvement and making these kinds of applications
8
9 more accessible to the general population without reducing their efficacy. The results of
10
11 the present trial support the hypothesis that both the VRET system and the presence of
12
13 the therapist in CAE-T increase the user's satisfaction and/or expectations for treatment,
14
15 at least in the short term; additionally, they reduce the aversiveness of the intervention
16
17 to some extent, although not to statistically significant levels. Future studies should
18
19 explore which kinds of treatment conditions are most compatible with patient
20
21 characteristics in order to maximize the intervention's efficiency.
22
23
24
25
26

27 The main limitation of our study is the relatively small number of participants in
28
29 each treatment condition, which clearly compromises the statistical import of our
30
31 results. Nevertheless, the number of subjects included in our study is not dramatically
32
33 smaller than in other computer-based exposure treatment studies. To our knowledge, the
34
35 largest sample in a fear of flying treatment study using virtual reality included 83
36
37 enrolled participants and 75 completers (Rothbaum et al., 2006). In the majority of these
38
39 kinds of studies, the sample size is smaller than that of in the present trial (e.g.
40
41 Rothbaum et al., 2000; Maltby et al., 2002; Mühlberger et al., 2001, 2003). Although
42
43 our sample size was limited, the innovative approach of the trial is noteworthy, as well
44
45 are its provocative results. At the very least, they serve as a point of comparison in these
46
47 kinds of interventions.
48
49
50
51
52

53 Another limitation of the study is the absence of a behavioral avoidance test at
54
55 the initial assessment. Behavioral avoidance tests for fear of flying are very difficult and
56
57 costly to conduct. In fact, they are not included in most flight phobia treatment
58
59 controlled trials. However, the degree of self-reported avoidance was very high in all
60

1
2
3 groups, and no participants who presented only slight fears were included in the study.
4
5
6 Therefore, we believe the lack of a behavioral avoidance test at baseline is not a serious
7
8 shortcoming for the trial, although we must cautiously evaluate the results regarding the
9
10 number of participants who flew at post-treatment.
11

12
13 A third limitation is the absence of a control group. Of course, including a
14
15 control condition would have strengthened the current study, though there were two
16
17 reasons this was not done. Firstly, previous studies comparing CAE treatment assisted
18
19 by a therapist and VRET with control conditions have provided evidence about their
20
21 superior efficacy with control groups. Furthermore, other researchers (e.g., Öst, 1997)
22
23 have indicated that the absence of a control group without treatment is not a crucial
24
25 methodological problem in studies examining the efficacy of treatments for specific
26
27 phobias; this is due to the clear superiority of these treatments and the almost
28
29 insignificant proportion of participants who naturally recover over time. Secondly, the
30
31 inclusion of a control group in this particular study would have required us to further
32
33 reduce the number of participants in each group.
34
35
36
37

38
39 Despite these limitations, results of our study shed light on certain topics that are
40
41 central to the research and dissemination of computer-based exposure treatments and
42
43 add valuable insights to the existing literature.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Acknowledgments

Funding for the study was provided by grants SEJ2005-00899/PSIC, SEJ-2006-14301/PSIC, PROMETEO/2008/157, and CIBER Fisiopatologia de la Obesidad y Nutricion - ISCIII CB06/03/0052 from the Spanish Government.

For Peer Review

References

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
- Andersson, G. (2009). Using the Internet to provide cognitive behaviour therapy. *Behaviour Research and Therapy*, *47*, 175–180. doi: 10.1016/j.brat.2009.01.010
- Anderson, P., Jacobs, C. H., & Rothbaum, B. O. (2004). Computer-supported cognitive behavioral treatment of anxiety disorders. *Journal of Clinical Psychology*, *60*, 253-267. doi: 10.1002/jclp.10262
- Anthony, M. M., Orsillo, S. M., & Roemer, L. (2001). *Practitioner's Guide to Empirically Based Measures of Anxiety*. New York: Plenum.
- Baños, R. M., Botella, C., Perpiñá, C., Alcañiz, M., Lozano, J. A., Osma, J., & Gallardo, M. (2002) Virtual Reality Treatment of Flying Phobia. *IEEE- Transactions on Information Technology in BioMedicine*, *6*, 206-212. doi: 10.1109/TITB.2002.802380
- Borkovec, T. D., & Nau, S. D. (1972). Credibility of analogue therapy rationales. *Journal of Behaviour Therapy and Experimental Psychiatry*, *3*, 257-260. doi:10.1016/0005-7916(72)90045-6
- Bornas, X., Fullana, M. A., Tortella-Feliu, M., Llabrés, J., & García de la Banda, G. (2001). Computer-assisted therapy in the treatment of flight phobia: a case report. *Cognitive and Behavioral Practice*, *8*, 234-240. doi:10.1016/S1077-7229(01)80058-4
- Bornas, X., Llabrés, J., Noguera, M., López, A. M., Barceló, F., Tortella-Feliu, M., & Fullana, M. A. (2004). Self-implication and heart rate variability during simulated exposure to flight-related stimuli. *Anxiety, Stress, and Coping*, *17*, 331-339. doi: 10.1080/10615800512331328777

- 1
2
3 Bornas, X., Tortella-Feliu, M., Fullana, M. A., & Llabrés, J. (2001). Computer-assisted
4 treatment of flight phobia: a controlled study. *Psychotherapy Research, 11*, 259-273.
5
6 doi:10.1080/713663983
7
8
9
10 Bornas, X., Tortella-Feliu, M., García de la Banda, G., Fullana, M. A., & Llabrés, J.
11
12 (1999). Validación factorial del Cuestionario de Miedo a Volar [Factorial validation
13 of the Fear of Flying Questionnaire]. *Análisis y Modificación de Conducta, 25*, 885-
14
15 907.
16
17
18
19 Bornas, X., Tortella-Feliu, M., & Llabrés, J. (2006). Do all treatments work for flight
20
21 phobia? Computer-assisted exposure versus a brief multicomponent nonexposure
22
23 treatment. *Psychotherapy Research, 16*, 41-50. doi: 10.1080/10503300500091058
24
25
26
27 Bornas, X., Tortella-Feliu, M., Llabrés, J., Barceló, F., Pauli, P., & Mühlberger, A.
28
29 (2002). Clinical usefulness of a simulated exposure treatment for fear of flying.
30
31 *International Journal of Clinical and Health Psychology, 2*, 247-262. Retrieved from
32
33 <http://www.aepc.es/ijchp/busca.php?coid=English>
34
35
36 Botella, C., Osma, J., García-Palacios, A., Quero, S., & Baños, R. M. (2004). Treatment
37
38 of flying phobia using virtual reality: Data from a 1-year follow-up using multiple
39
40 baseline design. *Clinical Psychology and Psychotherapy, 11*, 311-323. doi:
41
42 10.1002/cpp.404
43
44
45
46 Botella, C., Quero, S., Baños, R. M., García-Palacios, A., Bretón-López, J., Alcañiz,
47
48 M., & Fabregat, S. (2008). Telepsychology and Self-Help: The Treatment of Phobias
49
50 Using the Internet. *CyberPsychology and Behavior, 11*, 659-664.
51
52
53 doi:10.1089/cpb.2008.0012
54
55
56 Botella, C., Quero, S., Baños, R. M., Perpiñà, C., García-Palacios, A., & Riva, G.
57
58 (2006). Virtual reality and psychotherapy. In G. Riva, C. Botella, P. Légeron, & G.
59
60 Optale (Eds.), *Cybertherapy. Internet and virtual reality as assessment and*

1
2
3 *rehabilitation tools fro clinical psychology and neuroscience* (pp. 37-52).

4
5
6 Amsterdam: IOS Press.

7
8 Bowers, W., Stuart , S., & MacFarlane, R. (1993). Use of computer-administered
9
10 cognitive- behavior therapy with depressed patients. *Depression, 1*, 294–299. doi:
11
12 10.1002/depr.3050010603

13
14
15 Brown, T. A., DiNardo, P. A., & Barlow, D. H. (1994). *Anxiety Disorders Interview*
16
17 *Schedule for DSM-IV (ADIS-IV). Adults version*. Albany, NY: Graywind
18
19 Publications.

20
21
22 Cavanagh, K., Shapiro, D. A., Van Den Berg, S., Swain, S., Barkham, M. & Proudfoot,
23
24 J. (2009). The Acceptability of Computer-Aided Cognitive Behavioural Therapy: A
25
26 Pragmatic Study. *Cognitive Behaviour Therapy, 38*, 235-246. doi
27
28 10.1080/16506070802561256

29
30
31 Cuijpers, P., Marks, I., van Straten, A., Cavanagh, K., & Andersson, G. (2009).
32
33 Computer-aided psychotherapy for anxiety disorders: A meta-analytic review.
34
35 *Cognitive Behaviour Therapy, 38*, 66-82. doi: 10.1080/16506070802694776

36
37
38 Devilly, G. J., & Borkovec, T. D. (2000). Psychometric properties of the
39
40 credibility/expectancy questionnaire. *Journal of Behavior Therapy, 31*, 73-86.
41
42 doi:10.1016/S0005-7916(00)00012-4

43
44
45 Graham, C., Franses, A., Kenwright, M., & Marks, I. M. (2000). Psychotherapy by
46
47 computer: A postal survey of responders to a teletext article. *Psychiatric Bulletin, 24*,
48
49 331–332. doi: 10.1192/pb.24.9.331

50
51
52 Haug, T., Brenne, L., Johnsen, D. H., Brentzen, D., Götestam, K. G., & Hughdal, K.
53
54 (1987). A three systems analysis of fear of flying: A comparison of a consonant
55
56 versus a non-consonant treatment method. *Behaviour Research and Therapy, 25*,
57
58 187-194. doi:10.1016/0005-7967(87)90045-3
59
60

- 1
2
3 Jacobson, N. S., & Truax, P. (1991). Clinical significance: a statistical approach to
4
5 defining meaningful change in psychotherapy research. *Journal of Consulting and*
6
7 *Clinical Psychology*, 59, 12-19. Retrieved from
8
9 <http://www.sciencedirect.com/science/journal/0022006X>
10
11
12 Kaltenthaler, E., Parry, G., & Beverley, C. (2004). Computerized cognitive behaviour
13
14 therapy: A systematic review. *Behavioural and Cognitive Psychotherapy*, 32, 31-55.
15
16 doi:10.1017/S135246580400102X
17
18
19 Krijn, M., Emmelkamp, P. M. G., Olafsson, R. P., & Biemond, R. (2004). Virtual
20
21 reality exposure therapy of anxiety disorders: A review. *Clinical Psychology Review*,
22
23 24, 259-281. doi:10.1016/j.cpr.2004.04.001
24
25
26
27 Krijn, M., Emmelkamp, P. M. G., Olafsson, R. P., Bouwman, M., van Gerwen, L. J.,
28
29 Spinhoven, P., ... van der Mast, C. A. P. G. (2007). Fear of flying treatment
30
31 methods: Virtual reality exposure vs. cognitive behavioral therapy. *Aviation, Space,*
32
33 *and Environmental Medicine*, 78, 121-128. Retrieved from
34
35 <http://www.ingentaconnect.com/content/asma/asm>
36
37
38
39 Maltby, N., Kirsch, I., Mayers, M., & Allen, G. J. (2002). Virtual reality exposure
40
41 therapy for the treatment of fear of flying: a controlled investigation. *Journal of*
42
43 *Consulting and Clinical Psychology*, 70, 1112-1118. Retrieved from
44
45 <http://www.sciencedirect.com/science/journal/0022006X>
46
47
48 Marks, I., & Cavanagh, K. (2009). Computer-aided psychological treatments (CP):
49
50 Evolving issues. *Annual Review of Clinical Psychology*, 5, 163-183. doi:
51
52 10.1146/annurev.clinpsy.032408.153538
53
54
55 Marks, I. M., Cavanagh, K., & Gega, L. (2007a). *Hands-on Help. Computer-aided*
56
57 *Psychotherapy*. Hove: Psychology Press.
58
59
60

- 1
2
3 Marks, I. M., Cavanagh, K., & Gega, L. (2007b). Computer-aided psychotherapy:
4 revolution or bubble? *British Journal of Psychiatry*, *191*, 417-473. doi:
5
6 10.1192/bjp.bp.107.041152
7
8
9
10 Marks, I. M., Kenwright, M., McDonough, M., Whittaker, M., & Mataix-Cols, D.
11 (2004). Saving clinicians' time by delegating routine aspects of therapy to a
12 computer: A RCT in phobia/panic disorder. *Psychological Medicine*, *34*, 9–18.
13
14
15
16
17 doi:10.1017/S003329170300878X
18
19
20 McCrone P., Marks I. M., Greist J. H., Baer L., Kobak K. A., Wenzel K.W., & Hirsch
21 M. J. (2007). Cost-effectiveness of computer-aided behaviour therapy for obsessive-
22 compulsive disorder. *Psychotherapy and Psychosomatics*, *76*, 249-250.
23
24
25
26
27 doi:10.1159/000101504
28
29
30 Mühlberger, A., Herrmann, M., Wiedemann, G., Ellgring, H., & Pauli, P. (2001).
31 Treatment of fear of flying with exposure therapy in virtual reality. *Behaviour*
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
- Mühlberger, A., Weik, A., Pauli, P., & Wiedemann, G. (2006). One-sessions virtual reality exposure treatment for fear of flying: 1-year follow-up and graduation flight accompaniment effects. *Psychotherapy Research*, *16*, 26-40. doi: 10.1080/10503300500090944
- Mühlberger, A., Wiedemann, G., & Pauli, P. (2003). Efficacy of a one-session virtual reality exposure treatment for fear of flying. *Psychotherapy Research*, *13*, 323-336. doi: 10.1093/ptr/kpg030
- Öst, L. G. (1997). Rapid treatment of specific phobias. In G. C. L. Davey (Ed.), *Phobias. A handbook of theory, research and treatment* (pp. 227-246). Chichester, UK: Wiley.

- 1
2
3 Öst, L. G., Stridh, B. M., & Wolf, M. (1998). A clinical study of spider phobia.
4
5 Prediction of outcome after self-help and therapist-directed treatments. *Behaviour*
6
7 *Research and Therapy*, 36, 17-35. doi:10.1016/S0005-7967(97)10018-3
8
9
10 Palmqvist, B., Carlbring, P., & Andersson, G. (2007). Internet-delivered treatments with
11
12 or without therapist input: does the therapist factor have implications for efficacy
13
14 and cost? *Expert Review of Pharmacoeconomics & Outcomes Research*, 7, 291-297.
15
16
17 doi: 10.1586/14737167.7.3.291
18
19
20 Parsons, T. D., & Rizzo, A. A. (2008). Affective outcomes of virtual reality exposure
21
22 therapy for anxiety and specific phobias: A meta-analysis. *Journal of Behavior*
23
24 *Therapy and Experimental Psychiatry*, 39, 250-261. doi:10.1016/j.jbtep.2007.07.007
25
26
27 Powers, M. B., & Emmelkamp, P. M. G. (2008). Virtual reality exposure therapy for
28
29 anxiety disorders: A meta-analysis. *Journal of Anxiety Disorders*, 22, 561-569.
30
31
32 doi:10.1016/j.janxdis.2007.04.006
33
34
35 Rothbaum, B. O., Anderson, P., Zimand, E., Hodges, L., Lang, D., & Wilson, J. (2006).
36
37 Virtual reality exposure therapy and standard (in vivo) exposure therapy in the
38
39 treatment of fear of flying. *Behavior Therapy*, 37, 80-90.
40
41
42 doi:10.1016/j.beth.2005.04.004
43
44
45 Rothbaum, B. O., Hodges, L., Smith, S., Lee, J. H., & Price, L. (2000). A controlled
46
47 study of virtual reality exposure therapy for the fear of flying. *Journal of Consulting*
48
49 *and Clinical Psychology*, 68, 1020-1026. Retrieved from
50
51 <http://www.sciencedirect.com/science/journal/00057894>
52
53
54 Wiederhold, B. K., & Wiederhold, M. D. (2003). Three-year follow-up for virtual
55
56 reality exposure for fear of flying. *CyberPsychology and Behavior*, 6, 441-445.
57
58
59
60 doi:10.1089/109493103322278844

1
2
3 Whitfield, G., & Williams, C. (2004). If the evidence is so good—why doesn't anyone
4 use them? A national survey of the use of computer-aided cognitive behaviour
5 therapy. *Behavioural and Cognitive Psychotherapy*, 32, 57–65.
6
7
8
9
10 doi:10.1017/S1352465804001031
11

12
13 Wolitzky-Taylor, K. B., Horowitz, J. D., Powers, M. B., & Telch, M. J. (2008).
14 Psychological approaches in the treatment of specific phobias: A meta-analysis.
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Clinical Psychology Review, 28, 1021-1037. doi:10.1016/j.cpr.2008.02.007

For Peer Review

Table 1.

Descriptive statistics of sample by treatment group

| | CAE-T ^a (N=20) | CAE-SA ^b (N=21) | VRET ^c (N=19) | <i>p</i> |
|---|---------------------------|----------------------------|--------------------------|----------|
| | n/M (% , SD) | n/M (% , SD) | n/M (% , SD) | |
| Gender (female) | 15 (75%) | 10 (52.38%) | 10 (52.63%) | .171 |
| Age (in years) | 38 (10.24) | 36.24 (8.51) | 36.89 (11.71) | .877 |
| FFS ^d | 59.90 (8.21) | 60.67 (7.19) | 61.89 (8.40) | .732 |
| FFQ ^e | 184.40(39.05) | 185.33 (22.54) | 194.42(30.27) | .547 |
| Fear ADIS-IV ^f | 7.55 (.69) | 7.33 (.86) | 7.26 (.87) | .514 |
| Avoidance ADIS-IV | 7.10 (1.55) | 7.14 (1.28) | 6.79 (1.44) | .700 |
| Interference ADIS-IV | 5.80 (1.44) | 5.76 (1.45) | 5.63 (2.54) | .957 |
| Severity CR ^g | 5.90 (1.41) | 5.90 (1.41) | 6.21 (1.23) | .717 |
| Time avoiding (in months since last flight) | 59.11 (77.07) | 36.61 (46.56) | 52.25 (88.86) | .636 |

Computer-aided exposure with therapist assistance^a, Self-administered computer-aided exposure^b; Virtual reality exposure treatment^c.

Fear of Flying Scale^d; Fear of Flying Questionnaire^e; Anxiety Disorders Interview Schedule for DSM-IV^f; Clinician's rating^g

Table 2.

Means, standard deviations, and repeated measures analysis for effects of treatment at posttreatment on self-reported fear of flying measures, interview data, and external evaluator intent-to-treat (ITT) analyses

| | Pretreatment | Posttreatment | <i>d</i> | Follow-up | <i>d</i> | <i>F</i> ^a | Pairwise comparisons |
|---------------------|---------------|----------------|----------|----------------|----------|---|--|
| | <i>M (SD)</i> | <i>M (SD)</i> | | <i>M (SD)</i> | | | <i>F (1, 57)</i> |
| FFS ^e | | | | | | Time = 54.50, <i>p</i> = .0001 | <i>Pre</i> ⁱ – <i>post</i> ^j |
| CAE-T ^b | 59.90 (8.21) | 46.60 (12.96) | 1.21 | 46.60 (14.22) | 1.12 | Group = 0.45, <i>p</i> = 639 n.s. | 8.73, <i>p</i> = .0001 |
| CAE-SA ^c | 60.70 (7.18) | 49.60 (12.50) | 1.07 | 50.81 (11.74) | 0.99 | Interaction = 41.37, <i>p</i> = .671 n.s. | <i>Pre</i> – <i>FU</i> ^k |
| VRET ^d | 61.90 (8.40) | 45.70 (10.30) | 1.68 | 48.05 (12.88) | 1.25 | | 7.97, <i>p</i> = .0001 |
| | | | | | | | <i>Post</i> – <i>FU</i> |
| | | | | | | | -1.02, <i>p</i> = .931 |
| FFQ ^f | | | | | | Time = 72.83, <i>p</i> = .0001 | <i>Pre</i> – <i>post</i> |
| CAE-T | 184.40(39.05) | 122.40 (51.50) | 1.33 | 128.70 (56.17) | 1.13 | Group = 0.32, <i>p</i> = .733 n.s. | 10.91, <i>p</i> = .0001 |

| | | | | | | | | |
|----|----------------------|----------------|----------------|------|----------------|------|--------------------------------------|--------------------|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | CAE-SA | 185.33 (22.54) | 129.43 (38.00) | 1.76 | 133.67 (45.87) | 1.40 | Interaction = 1.15 , $p = .337$ n.s. | <i>Pre - FU</i> |
| 5 | | | | | | | | |
| 6 | VRET | 194.42(30.27) | 109.03 (40.60) | 2.34 | 120.68 (50.75) | 1.73 | | 8.25, $p = .0001$ |
| 7 | | | | | | | | |
| 8 | | | | | | | | <i>Post - FU</i> |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | -1.60, $p = .344$ |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | ADIS-IV ^g | | | | | | | |
| 15 | | | | | | | | |
| 16 | <i>Fear</i> | | | | | | Time = 72.42, $p = .0001$ | <i>Pre - post</i> |
| 17 | | | | | | | | |
| 18 | CAE-T | 7.55 (.69) | 4.00 (2.55) | 1.86 | 5.00 (2.39) | 1.42 | Group = 0.21, $p = .809$ n.s. | 10.76, $p = .0001$ |
| 19 | | | | | | | | |
| 20 | CAE-SA | 7.33 (.86) | 4.43 (2.28) | 1.53 | 4.95 (2.27) | 1.36 | Interaction = 0.26, $p = .902$ n.s. | <i>Pre - FU</i> |
| 21 | | | | | | | | |
| 22 | VRET | 7.26 (.87) | 3.84 (2.36) | 1.88 | 4.68 (2.47) | 1.36 | | 8,56, $p = .0001$ |
| 23 | | | | | | | | |
| 24 | | | | | | | | <i>Post - FU</i> |
| 25 | | | | | | | | |
| 26 | | | | | | | | -0.26, $p = .010$ |
| 27 | | | | | | | | |
| 28 | | | | | | | | |
| 29 | | | | | | | | |
| 30 | | | | | | | | |
| 31 | | | | | | | | |
| 32 | | | | | | | | |
| 33 | | | | | | | | |
| 34 | | | | | | | | |
| 35 | | | | | | | | |
| 36 | | | | | | | | |
| 37 | | | | | | | | |
| 38 | | | | | | | | |
| 39 | | | | | | | | |
| 40 | | | | | | | | |
| 41 | | | | | | | | |
| 42 | | | | | | | | |
| 43 | | | | | | | | |
| 44 | | | | | | | | |
| 45 | | | | | | | | |
| 46 | | | | | | | | |
| 47 | | | | | | | | |

VR and CAE treatments 4

| | | | | | | | | |
|----|--------------------------|-------------|-------------|------|-------------|---------------------------|-------------------------------------|--------------------|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | <i>Avoidance</i> | | | | | Time = 63.60, $p = .0001$ | | <i>Pre - post</i> |
| 6 | | | | | | | | |
| 7 | CAE-T | 7.10 (1.55) | 3.05 (3.35) | 1.52 | 4.45 (3.27) | 1.02 | Group = 0.38, $p = .683$ n.s. | 9.84, $p = .0001$ |
| 8 | | | | | | | | |
| 9 | CAE-SA | 7.14 (1.28) | 3.57 (3.19) | 1.44 | 4.43 (2.98) | 1.16 | Interaction = 0.17, $p = .953$ n.s. | <i>Pre - FU</i> |
| 10 | | | | | | | | |
| 11 | VRET | 6.79 (1.44) | 2.63 (2.90) | 1.78 | 3.95 (3.15) | 1.13 | | 7.41, $p = .0001$ |
| 12 | | | | | | | | |
| 13 | | | | | | | | <i>Post - FU</i> |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | | | | | | | -4.04, $p = .0001$ |
| 17 | | | | | | | | |
| 18 | <i>Interference</i> | | | | | | | |
| 19 | | | | | | Time = 45.50, $p = .0001$ | | <i>Pre - post</i> |
| 20 | | | | | | | | |
| 21 | CAE-T | 5.80 (1.44) | 2.50 (2.19) | 1.75 | 3.90 (2.34) | 0.96 | Group = 0.16, $p = .854$ n.s. | 8.72, $p = .0001$ |
| 22 | | | | | | | | |
| 23 | CAE-SA | 5.76 (1.45) | 3.19 (2.44) | 1.26 | 3.29 (2.37) | 1.23 | Interaction = 3.15, $p = .945$ n.s. | <i>Pre - FU</i> |
| 24 | | | | | | | | |
| 25 | VRET | 5.63 (2.54) | 2.16 (2.46) | 1.36 | 3.63 (2.85) | 0.73 | | 6.02, $p = .0001$ |
| 26 | | | | | | | | |
| 27 | | | | | | | | <i>Post - FU</i> |
| 28 | | | | | | | | |
| 29 | | | | | | | | |
| 30 | | | | | | | | -3.46, $p = .003$ |
| 31 | | | | | | | | |
| 32 | | | | | | | | |
| 33 | Severity CR ^h | | | | | | | |
| 34 | | | | | | Time = 58.36, $p = .0001$ | | <i>Pre - post</i> |
| 35 | | | | | | | | |
| 36 | CAE-T | 5.90 (1.41) | 3.10 (2.45) | 1.37 | 4.10 (2.42) | 0.89 | Group = 0.22, $p = .805$ n.s. | 9.79, $p = .0001$ |
| 37 | | | | | | | | |
| 38 | CAE-SA | 5.90 (1.41) | 3.48 (2.52) | 1.16 | 3.86 (2.63) | 0.95 | Interaction = 1.00, $p = .408$ n.s. | <i>Pre - FU</i> |
| 39 | | | | | | | | |
| 40 | | | | | | | | |
| 41 | | | | | | | | |
| 42 | | | | | | | | |
| 43 | | | | | | | | |
| 44 | | | | | | | | |
| 45 | | | | | | | | |
| 46 | | | | | | | | |
| 47 | | | | | | | | |

VR and CAE treatments 5

1
2
3
4 VRET 6.21 (1.23) 2.63 (2.06) 2.07 3.37 (2.73) 1.31 7.58, $p = .0001$
5
6

7 *Post - FU*
8

9 $-2.77, p = .023$
10

11 Degrees of freedom and error for F values: time $F (2, 114)$, group $F (2, 57)$, interaction $F (2, 114)$ ^a.
12

13 Computer-aided exposure with therapist assistance^b, Self-administered computer-aided exposure^c; Virtual reality exposure treatment^d.
14

15 Fear of Flying Scale^e; Fear of Flying Questionnaire^f; Anxiety Disorders Interview Schedule for DSM-IV^g; Clinician's rating^h; Pretreatmentⁱ;
16
17

18 Post-treatmentⁱ; One-year follow-up^k.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table 3.

Clinically meaningful improvement on the Fear of Flying Questionnaire (FFQ) scores and diagnostic status at post-treatment for those who completed treatment or attended one-year follow-up and intent-to-treat analyses

| | At Posttreatment | | | At One-year Follow-up | | |
|-----------------------------|--------------------|---------------------|-------------------|-----------------------|---------------------|-------------------|
| | CAE-T ^a | CAE-SA ^b | VRET ^c | CAE-T ^a | CAE-SA ^b | VRET ^c |
| | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) |
| <i>Clinical Improvement</i> | | | | | | |
| Recovered | | | | | | |
| Completers | 9 (47.4%) | 10 (52.6%) | 12 (66.7%) | 5 (35.7%) | 4 (33.3%) | 6 (50%) |
| ITT ^d | 9 (45%) | 10 (47.6%) | 12 (63.2%) | 6 (30%) | 8 (38.1%) | 11 (57.9%) |
| Improved | | | | | | |
| Completers | 7 (36.8%) | 7 (36.8%) | 6 (33.3%) | 7 (50%) | 6 (50%) | 2 (16.7%) |
| ITT | 7 (35%) | 7 (33.30%) | 6 (31.60%) | 10 (50%) | 8 (38.1%) | 3 (15.8%) |
| No change | | | | | | |
| Completers | 3 (15.8%) | 2 (10.5%) | 0 (0%) | 2 (14.3%) | 2 (16.7%) | 4 (33.3%) |

ITT 4 (20%) 4 (19%) 1 (5.3%) 4 (20%) 5 (23.8%) 5 (26.3%)

Completers (n = 56): $\chi^2(4) = 3.37, p = .499$

Completers (n=38): $\chi^2(4) = 4.08, p = .394$

ITT (n = 60): $\chi^2(4) = 2.54, p = .641$

ITT (n=60): $\chi^2(4) = 5.43, p = .246$

Diagnostic Status

No diagnosis

Completers 12(66.7%) 11 (61.1%) 13 (76.5%)

7 (50%) 6 (50%) 6 (50%)

ITT 12 (60%) 11 (52.4%) 13 (68.4%)

8 (40%) 10 (47.6%) 10 (52.6%)

Completers (n=56): $\chi^2(2) = 0.97, p = .617$

Completers (n=38): $\chi^2(2) = 0.00, p = 1.00$

ITT (n=56): $\chi^2(2) = 1.07, p = .586$

ITT (n=60): $\chi^2(2) = .636, p = .727$

Computer-aided exposure with therapist assistance^a, Self-administered computer-aided exposure^b; Virtual reality exposure treatment^c.

Intent-to-treat analysis^d

1
2
3 Dr. Miquel Tortella-Feliu is Senior Lecturer in Behavior Therapy at the Department of
4 Psychology, University of the Balearic Islands (Majorca). His main research interests
5 are anxiety disorders.
6
7

8 Dr. Cristina Botella is Full Professor of Clinical Psychology and Director of the
9 Emotional Disorders Clinic at Jaume I University, Spain. Her main line of research is
10 the design and testing of clinical applications based on information and communication
11 technologies for the treatment of emotional disorders.
12

13
14 Dr. Jordi Llabrés is Senior Lecturer in Psychological Treatments at the Department of
15 Psychology, University of the Balearic Islands (Majorca). His main research area is
16 computer-aided cognitive-behavior therapy.
17

18
19 Dr. Juana María Bretón-López is a Lecturer (Assistant Professor) at the
20 Universitat Jaume I, Spain. Her main research interests are anxiety disorders, especially
21 phobic disorders and the application of new technologies to treat these. Bretón has a
22 PhD in Clinical Psychology from the University of Granada.
23

24
25 Antonio Riera del Amo is a doctoral student at Jaume I University, Spain, where he is
26 working in the design and testing of clinical applications based on information and
27 communication technologies for the treatment of emotional disorders.
28

29
30 Dr. Rosa M. Baños is Full Professor of Psychopathology at the Universidad de
31 Valencia, Spain. Her research interests include psychopathology, the treatment of
32 psychological disorders, and the application of VR to Clinical Psychology. She has a
33 PhD in Psychology from the University of Valencia.
34

35
36 Joan M. Gelabert is a doctoral student and clinical research assistant at the University
37 of the Balearic Islands. He is also behavior therapist at USP Palmaplanas Hospital. His
38 main research interests are computer-aided cognitive-behavior therapies.
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60