Cognitive Therapy and Research
https://doi.org/10.1007/s10608-022-10343-8

ORIGINAL ARTICLE

Therapeutic Alliance and Treatment Expectations: Predicting Outcomes in Exposure Treatments for Specific Phobia

Malenka Areas[1] · Anna Margarete Babl[2,3] · Javier Fernández-Álvarez[4,5] · Andrés Roussos[1] · Cristina Botella[5] · Azucena García-Palacios[5] · Rosa Baños[6] · Soledad Quero[5] · Juana María Breton[5] · Juan Martín Gómez Penedo[1]

Accepted: 12 November 2022

Abstract

Background Exposure-based treatments have demonstrated some of the largest effect sizes in the treatment of specific phobias (SP). There are different ways of delivering exposure such as Augmented Reality Exposure which has become an interesting alternative to In Vivo Exposure for treating SP. The present study aimed to investigate the therapeutic alliance and treatment expectations as possible predictors of treatment outcomes in these two exposure treatment conditions.

Methods Participants were 63 adults who met diagnostic criteria for the diagnosis of a SP of cockroaches or spiders (animal subtype). Patients were randomized to receive a one-session treatment of either In Vivo Exposure (N = 31) or Augmented Reality Exposure (N = 32). The assessment protocol included diagnostic, as well as primary-, and secondary outcome measures. Materials included the Behavioral Avoidance Test for measuring symptoms and outcomes, the Expectations and Satisfaction Questionnaire, and the Working Alliance Inventory. We ran multilevel analyses for the study of predictors controlling for the treatment effect conditions.

Results Results showed a significant effect of expectations on treatment outcomes (specifically avoidance and beliefs scores). The therapeutic alliance did not have a significant effect on treatment outcome. Patients reduced their symptoms of phobia.

Conclusion These results empirically support treatment expectations as a relevant predictor of change in exposure treatments for SP.

Keywords Specific phobia · Augmented reality exposure · In vivo exposure · Treatment · Therapeutic alliance · Treatment expectations

Introduction

Over the last decades, psychotherapy research has provided empirical support for psychological treatments. To date, exposure-based treatments have demonstrated some of the largest effects in treating anxiety disorders such as specific phobias (SP) (e.g., Abramowitz et al., 2019; Botella et al., 2016). Meta-analytic findings suggest that repeated systematic engagement with feared stimuli is an essential component of treatments for anxiety disorders (Kaczkurkin & Foa, 2015).

Exposure involves helping patients to confront their feared stimuli on a repeated and prolonged basis (Abramowitz et al., 2019) and can be conducted in different forms: In Vivo Exposure (IVE), imaginal, and through Virtual Reality (VR) (Eaton et al., 2018). In IVE, therapists have their clients confront feared stimuli in a safe, real-life environment (Hazlett-Stevens & Craske, 2009). The real-life exposure

✉ Malenka Areas
malenka.areas@gmail.com

1 Department of Psychology, University of Buenos Aires & CONICET, Lavalle 2353, 1052 Buenos Aires, Argentina

2 Clinical Psychology and Psychotherapy Department, University of Bern, Bern, Switzerland

3 Adelphi University, New York, NY, USA

4 Asociación Aiglé Valencia, Valencia, Spain

5 Department of Basic and Clinical Psychology and Psychobiology, Universitat Jaume I, Castello de la Plana, Spain

6 Departamento de Personalidad, Evaluación y Tratamientos Psicológicos, Universidad de Valencia, Valencia, Spain

Published online: 23 November 2022

to feared stimuli can provide a real confrontation of feared stimuli, and allows patients to learn and tolerate their anxiety at the moment. This form of exposure can be considered the most traditional and has gathered substantial evidence for its effectiveness.

Throughout the years, new ways to conduct exposure have emerged. One way to approach exposure includes the use of technology which has shown to be a viable option for the treatment of SP (Botella et al., 2016, 2017; Maples-Keller et al., 2017). Among technological alternatives we find Augmented Reality Exposure (ARE). This technique combines the real world with virtual elements in real-time. This means that the person sees an image composed of a visualization of the real world and a series of virtual elements, which provides the person with relevant information that is not found in the real world (e.g., the person sees through the device the real environment but virtual cockroaches are added for activating fear).

Research has shown that ARE is an effective treatment for SP such as aviophobia (Rothbaum et al., 2006; Maltby et al., 2002; Shiban et al., 2017), arachnophobia (Garcia-Palacios et al., 2002), and claustrophobia (Botella et al., 2000; Wiederhold & Bouchard, 2014). It has also been demonstrated to be a useful tool in small animal phobias treatment (Botella et al., 2016; Wrzesien et al., 2015). As it gives the patient the opportunity of confronting the phobic stimuli in a real environment by means of VR and consequently extinguished by repeated and controlled exposure (Botella et al., 2017; Emmelkamp & Meyerbröker, 2021; Fernández-Álvarez, et al., 2020).

Both IVE and ARE have shown to be—on average—highly effective (Wechsler et al., 2019). However, there is scarce evidence regarding specific predictors of treatment success. Identifying those specific ingredients that make treatment effective is important to understand the underlying mechanisms of change better. Recent systematic reviews of factors influencing the success of exposure therapy for SP identify elements such as inhibitory learning, low trait anxiety, and high motivation (Böhnlein et al., 2019); affective styles and adjusting style (Totzeck et al., 2019); and patients with poor prognosis (Leehr et al., 2021).

A variable that has been shown to be a robust predictor of treatment outcome is the therapeutic alliance (Flückiger et al., 2018; Pan et al., 2011; Weck et al., 2015). According to the widely accepted tripartite definition proposed by Bordin (1979), this construct includes that: (a) the therapist and patient connect in a mutually supportive and respectful way (bond alliance), (b) the patient and therapist agree on treatment goals (goal alliance), and (c) the patient and therapist agree on the tasks implemented to reach such goals (task alliance). The therapeutic alliance may be critical in exposure-based treatments, as they involve confrontation with feared stimuli instead of avoidance (Buchholz & Abramowitz, 2020). Given this emphasis on behavioral change, research suggests that the task component (in comparison to the bond and goal alliance) has the most profound effect on the reduction of anxiety symptoms (Hagen et al., 2016; Wheaton et al., 2016).

Therapeutic alliance has been associated with treatment outcome in a one-session exposure for SP (Pan et al., 2011) and for anxiety (Weck et al., 2015). Furthermore, a study by Levy et al. (2016) provided preliminary evidence indicating that a strong therapeutic alliance can be developed with patients engaging in Virtual Reality Exposure Treatment (VRET) remotely. When studying the effect of the therapeutic alliance on treatment outcome, patients with a fear of flying associated therapeutic alliance positively with anxiety reduction (Meyerbroker & Emmelkamp, 2008). Moreover, in their study Wrzesien et al. (2012) found no difference in either of the three components of the therapeutic alliance between IVE and ARE treatment conditions. These results could be considered evidence of the impact of therapeutic alliance on different exposure treatments.

Another variable hypothesized to predict therapy outcomes is patients' positive expectancy of treatment success (Constantino et al., 2018). Specifically in VRET, Price et al. (2008) found that positive expectancies of patients concerning the outcome may enhance the improvement of anxiety symptoms. In their study, subjects with a fear of flying and higher expectancies of treatment success presented stronger symptom reduction on self-report measures. Along the same line, a study conducted by Wu et al. (2020) with children undergoing exposure treatments, found that higher expectations were associated with higher youth mastery. Suggesting that if a child or adolescent expected positive outcomes, he/she persisted more time with the assignments and developed proficiency with repeated exposure tasks (Wu et al., 2020). Also, Bretón-López et al. (2015) found that participants in VRET had greater expectations regarding the success of treatment than those in a computer-aided exposure (CAE-SA) condition. This is evidence of expectations showing an important role in exposure-based treatments.

Considering that there has been no detailed investigation of the predictive power of the therapeutic alliance and treatment expectancies for exposure treatment success, the present study aims to close this gap.

The following hypotheses were addressed: (hypothesis #1) a better therapeutic alliance predicts better treatment outcome, (hypothesis #2) higher treatment expectations predict better treatment outcome, (hypothesis #3) a positive interaction between alliance and expectations enhances treatment outcome.

The present study resulted as a secondary outcome of an original RCT conducted by Botella et al. (2016). The

main outcome paper showed no significant differences between the two treatment conditions in the long term. Taking those results into consideration we expect equal effects of the studied predictors on treatment outcome. However, analyses were run controlling for the effect of treatment conditions.

Methods

Participants

After advertisement, a total of 103 people contacted a Spanish University Clinic showing interest in taking part in the study. Out of these 103 people, 75 individuals were assessed for eligibility criteria in a first assessment session, after which twelve had to be excluded from the study because (1) they did not meet inclusion criteria (n = 2), (2) they refused to attend (n = 7), or (3) were not on call (n = 3). The total sample was N = 63, with 59 identifying as female (93.7%) and 4 as male (6.3%).

The data collection took place between January 2011 and January 2013. Inclusion criteria were: (a) meeting DSM-IV criteria for the diagnosis of SP (animal subtype) to cockroaches or spiders; (b) being at least 18 years old; (c) having a minimum 1-year duration of the phobia; (d) being willing to follow the study conditions and sign the consent form, and (e) presenting a score of at least 4 on the fear and avoidance scales of the diagnostic interview applied. Exclusion criteria were: (a) having another psychological problem that required immediate attention; (b) presenting current alcohol or drug dependence or abuse, psychosis or severe organic illness; (c) being currently treated in a similar treatment program; (d) being able to insert the hands in a plastic container with a cockroach or a spider (during the behavioral test); and (e) changing anxiolytics during the study (in the case of taking them).

The final sample had a mean age of 31.73 years (SD = 10.74), ranging from 20 to 70. About 49.2% of the sample was married and the other half (50.8%) was single. Most participants had a university degree (84.1%), and the others had finished high school (11.1%) or elementary school (4.8%). Two of the participants were taking anxiolytic drugs: one only occasionally due to a previous diagnosis of agoraphobia but not during the study period; the other to control binge-eating episodes in the framework of a previous eating disorder but kept the dose constant over the course of the study. Statistical analysis showed no differences between the two groups at pre-treatment on any demographic variables nor phobia duration or diagnostic variables. More information can be found in the main outcome paper (Botella et al., 2016).

Therapists

Five therapists were involved in the study, all of whom had a Ph.D. or a Master's degree in Psychology. They were trained in CBT and had between 2 and 5 years of experience in the treatment of anxiety disorders and in the exposure technique (either IVE or ARE). In addition, they received training in the protocol from senior clinicians following the recommendations of Öst et al. (1991). Depending on the availability of therapists, the clinician who performed the initial and follow-up assessment was different from the one who conducted the treatment, while in other cases the clinician was the same. All therapists conducted both IVE and ARE treatments. They received weekly supervision from senior clinicians. Moreover, all assessment and treatment sessions were video recorded for supervision purposes.

Treatment

Participants received a one-session treatment guideline developed by Öst et al. (1991). The treatment included several therapeutic components applied in only one individual session lasting up to 3 h. First, patients received psychoeducation, then exposure hierarchy was elaborated with the patient and this exposure was started together with the questioning of the irrational beliefs that the patient may have. Treatment components consisted of exposure, modeling, reinforced practice, and cognitive challenge.

Treatment was applied in two different ways: in the IVE condition, participants were exposed to real cockroaches or spiders; in the ARE condition, participants were exposed to virtual animals (cockroaches or spiders) using the ARE system. As already mentioned, ARE is a variant of IVE that integrates virtual objects into the real world calculating the positions of the camera. Augmented Reality allows digital content using computer graphics mixed to overlay real-world objects. The mean treatment duration was 137 min (ranging from 62 to 180) in the IVE condition and 141.83 min (ranging from 70 to 180) in the ARE condition. As some exposure sessions took three hours, few participants in both conditions reported adverse effects such as: feeling tired, dizzy and having back pain. More information can be found in the main outcome paper (Botella et al., 2016).

Augmented Reality System and Hardware

In relation to the system, two devices were used to display Mixed Reality images: (1) AR 5DT HMD (head-mounted display) with an 800 × 600 resolution and a high (40°) fields of view where a USB Creative NX-Ultra camera is attached to the HMD to capture video stream; and (2) VR Goggles (Vuzix) that include two LCD devices with a 640 × 480 resolution and a 30° field of view and an embedded camera. The

system includes 3D spiders and cockroaches and enables real-time interactivity. For more information see Botella et al. (2016).

Ethics Statement

Participants received information on informed consent during the admission session both verbally and in written form. Two consents were then provided by each participant. One regarding treatment and research participation and another including video-recorded authorization and data protection information.

Material

Patients went through a first session where they met the therapist. The therapist listened to their problem, and they agreed on treatment objectives, conditions, and participation. After this, therapeutic alliance and treatment expectations were assessed. Symptomatology was assessed through the BAT scale previously, after, and as a follow-up measure. All participants in both conditions received the same assessment. For the analysis, we considered fear, avoidance, and beliefs scores of the BAT dimensions. The assessment took place before and after treatment, as well as at 1-, 3- and 6-month follow-ups.

Behavioral Avoidance Test (BAT; Adapted by Öst et al., 1991)

The BAT is an observational measure used to assess the features of phobia in the context of exposure to the feared object, in order to obtain objective data about the person's fear. Participants are then exposed to the phobic object in a stepwise manner (i.e., in 10 steps). Their performance on the test is scored by transforming the distance into a score rated on a scale. The assessment includes different dimensions: fear, avoidance, beliefs, maximum anxiety experienced by the participant, and performance and severity of the fear assessed by the therapist.

Working Alliance Inventory Short Version (WAI-S; Adapted by Corbella & Botella, 2003)

The WAI-S is made up of 4 subscales (a) agreement on tasks, (b) agreement on goals, (c) positive link, and (d) theory of change. The WAI-S consists of a total of 12 Items which the client scores according to the original 7-point Likert scale ranging from 1 (not at all) to 7 (totally). The total WAI-S score ranges from 12 to 84 points and showed good internal consistency (α Cronbach = 0.80).

Expectations and Satisfaction Regarding the Exposure Treatment (Adapted by Borkovec & Nau, 1972)

This questionnaire measures the participants' expectations about the exposure component before the treatment and their satisfaction with it after the treatment. It includes six items rated from 0 (not at all) to 10 (very much). Items address how logical, satisfactory, recommendable, aversive and useful for the patient's problems the treatment is. Some examples are: "To what extent do you think this program would be useful in your case?", "To what extent do you find the treatment aversive?", "To what extent are you satisfied with the program you are about to receive?". It has shown good internal consistency (α Cronbach = 0.80). The adapted version of the scale has been used in previous studies (e.g., Baños et al., 2009; Botella et al., 2007, 2016).

Procedure

The study was based on a Randomized Controlled Trial (RCT), more detailed information can be found in the main outcome paper (Botella et al., 2016). First patients were assessed for eligibility criteria and were informed about the two treatment conditions and that they were going to be randomly assigned to one of the conditions. Then, patients were randomly assigned to receive either IVE (N = 31) or ARE (N = 32) through a computer-generated randomization list created by the "Random Allocation Software"; version 1.0. After this, patients had a first session where they gave written informed consent, and variables of interest were assessed (Therapeutic Alliance, Treatment Expectations, Symptomatology, etc.). Finally, they received a one-session exposure treatment, either IVE or ARE.

Statistical Analysis

Considering that in this study we have repeated measures nested within patients, we used multilevel models with a two-level structure (Level 1: repeated measures, Level 2: patients). Multilevel models account for the dependency of the data when there is a nested structure, they also have the advantage of handling missing data mimicking an intent-to-treat approach. This provides a more robust estimation of the parameters (Gómez Penedo et al., 2019; Raudenbush & Bryk, 2002). The analysis included the total scores of both assessed predictor variables (Therapeutic Alliance and Treatment Expectations). For each of the dependent variables (fear, avoidance, and beliefs scores) we ran the following models.

Time-As-Only-Predictor Models

To have an estimation of the rates of change during the follow-up period, we ran time-as-only-predictor models using BAT subscales as outcomes and including time (centered at the end of follow-up) as the only predictor. This model was conducted to estimate the change in outcome measures and for comparison purposes with the other models.

Level-1 Model

$$BAT_{ij} = \beta_{0j} + \beta_{1j} * \left(\text{Time}_{ij}\right) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (\text{PR\_BAT}) + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11} * (\text{PR\_BAT})$$

At Level 1, BAT scores in subject j at time i, were predicted by the estimated scores of BAT at the end of follow-up for patient j (β_{0j}) and the time effect during follow-up for patient j (β_{1j}). At Level 2, β_{0j} was predicted by the sample's mean BAT score at the end of follow-up (γ_{00}), while β_{1j} was predicted by the sample average time effect during follow-up (γ_{10}). We included baseline BAT to adjust for its effect both on the intercept and the slope.

Conditional Model to Determine Alliance and Expectations Main Effects

To estimate the expectation and alliance effects on BAT, we ran multilevel models with BAT scores (from post-treatment to the end of follow-up) as outcome. As level 1 predictor we incorporated time in months (centered at the end of follow-up). Then, we included expectations and alliance levels at baseline (grand-mean centered) as level 2 predictors of the intercept and the time effect. To control for initial levels of BAT we included baseline BAT as a level 2 predictor in the models. Furthermore, to adjust for condition effect we included condition coded as IVE = − .5; ARE = .5. We used the following equation:

Level-1 Model

$$BAT_{ij} = \beta_{0j} + \beta_{1j} * \left(\text{Time}_{ij}\right) + r_{ij}$$

Level-2 Model

$$\begin{aligned}\beta_{0j} = {} & \gamma_{00} + \gamma_{01} * \left(\text{C\_Wai}_{i}\right) + \gamma_{02} * \left(\text{C\_Exp}_{j}\right) \\ & + \gamma_{03} * \left(\text{Condition}_{i}\right) + \gamma_{04} * (\text{PR\_BAT}) + u_{0j} \\ \beta_{1j} = {} & \gamma_{10} + \gamma_{11} * \left(\text{C\_Wai}_{j}\right) + \gamma_{12} * \left(\text{C\_Exp}_{j}\right) \\ & + \gamma_{13} * \left(\text{Condition}_{j}\right) + \gamma_{14} * (\text{PR\_BAT})\end{aligned}$$

At Level 2, as targeted independent variables we included baseline alliance scores (grand-mean centered; C_Wai) as a predictor of the intercept (γ_{01}) and the time slope (γ_{11}), and baseline expectations (grand-mean centered; C_Exp) as a predictor of the intercept (γ_{02}) and time slope (γ_{12}). To adjust for treatment effects, we included the condition as a further predictor of the intercept (γ_{03}) and the slope (γ_{13}). Furthermore, we included baseline BAT as a predictor of both the intercept (γ_{04}) and slope (γ_{14}).

Interactive Effects of Expectations and Alliance with Treatment

Finally, we tested the interactive effect of expectations by therapeutic alliance on BAT, adjusting for treatment condition and previous BAT scores. For this model, we used the following equation:

Level-1 Model

$$BAT_{ij} = \beta_{0j} + \beta_{1j} * \left(\text{Time}_{ij}\right) + r_{ij}$$

Level-2 Model

$$\begin{aligned}\beta_{0j} = {} & \gamma_{00} + \gamma_{01} * \left(\text{C\_Wai}_{j}\right) + \gamma_{02} * \left(\text{C\_Exp}_{j}\right) \\ & + \gamma_{03} * \left(\text{C\_Exp\_X\_C\_Wai}_{j}\right) + \gamma_{04} * \left(\text{Condition}_{j}\right) \\ & + \gamma_{05} * (\text{PR\_BAT}) + u_{0j} \\ \beta_{1j} = {} & \gamma_{10} + \gamma_{11} * \left(\text{C\_Wai}_{j}\right) + \gamma_{12} * \left(\text{C\_Exp}_{j}\right) \\ & + \gamma_{13} * \left(\text{C\_Exp\_X\_C\_Wai}_{j}\right) \\ & + \gamma_{14} * \left(\text{Condition}_{j}\right) + \gamma_{15} * (\text{PR\_BAT})\end{aligned}$$

At Level 1, BAT scores at time i for patient j were predicted by patient j's estimated BAT score at the end of follow-up (β_{0j}) and the time effect during follow-up for patient j (β_{1j}). At Level 2, as targeted independent variables we included baseline alliance scores (grand-mean centered; C_Wai) as a predictor of the intercept (γ_{01}) and time slope (γ_{11}), baseline expectations (grand-mean centered; C_Exp) as a predictor of the intercept (γ_{02}) and the time slope (γ_{12}), and the interactive effect of expectations by alliance both on the intercept (γ_{03}) and the time slope (γ_{13}). As in the conditional models, to adjust for treatment effects, we included condition as a further predictor of the intercept (γ_{04}) and the slope (γ_{14}). Furthermore, we included baseline BAT as a predictor of both the intercept (γ_{05}) and slope (γ_{15}).

Results

Sample Descriptives

Descriptive statistics of treatment expectations, therapeutic alliance and BAT for both conditions separately are

Table 1 Sample descriptive for assesment at baseline and last follow-up

Assesment	Group	Baseline		Post-treatment		First follow-up		Second follow-up		Third follow-up	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Therapeutic Alliance											
	IVE	71.13	20.54								
	ARE	66.31	23.00								
Treatment Expectations											
	IVE	8.25	1.66								
	ARE	8.17	1.32								
BAT fear											
	IVE	8.39	2.32	3.16	3.18	3.48	2.82	2.84	2.67	3.65	3.19
	ARE	8.62	2.12	5.75	2.59	4.25	2.90	3.94	3.12	4.25	3.52
BAT avoidance											
	IVE	8.87	2.14	2.94	3.49	3.10	3.41	2.23	2.93	3.52	4.03
	ARE	8.50	2.05	5.56	3.15	3.59	3.70	3.22	4.04	3.97	4.39
BAT beliefs											
	IVE	8.42	2.92	3.03	3.07	2.55	2.80	1.90	2.64	3.00	3.62
	ARE	8.63	2.22	3.84	2.89	2.75	2.83	2.66	2.87	2.88	3.08

presented for baseline, post-treatment and follow-up period in Table 1.

Time-As-Only-Predictor Model

Results showed that participants had an estimated level of fear of 4.31 at the end of follow up, $\gamma_{00} = 4.31$, $SE = 1.32$, 95% CI [1.71, 6.91], $t(69) = 3.27$, $p < .001$. The model also showed an approach significance monthly reductions in the fear subscale, $\gamma_{10} = -0.20$, $SE = 0.11$, 95% CI [− 0.42, 0.01], $t(189) = -1.88$, $p = .06$. Every month there was a 0.20 units reduction in fear over the course of follow up.

In relation to the avoidance subscale, participants had an estimated level of avoidance of 2.82 at the end of the follow up, $\gamma_{00} = 2.82$, $SE = 1.79$, 95% CI [− 0.71, 6.34], $t(67) = 1.57$, $p = .12$. The model also showed an approach significance monthly reduction of 0.22 units in the avoidance subscale, $\gamma_{10} = -0.22$, $SE = 0.19$, 95% CI [− 0.45, 0.01], $t(189) = -1.85$, $p = .07$.

Finally, participants had an estimated level of beliefs of 2.34 at the end of follow up, $\gamma_{00} = 2.34$, $SE = 1.12$, 95% CI [0.14–4.55], $t(71) = 2.1$, $p < .005$. The model also showed an approach significance monthly reduction of 0.19 units in the belief subscale, $\gamma_{10} = -0.19$, $SE = 1.11$, 95% CI [− 0.40, 0.02], $t(189) = -1.74$, $p = .08$.

Conditional Model

In these models, we analyzed alliance and expectation effects on the three targeted dimensions of the BAT (i.e., fear, avoidance, and beliefs). Therapeutic alliance was first analyzed with WAI-S sub-scales, as results did not vary and for not adding more multiple comparisons, we decided to report the final models with the WAI-S total scores. Full results of the models are presented in Table 2 for the fear subscale, Table 3 for the avoidance subscale, and Table 4 for the beliefs subscale.

Table 2 Results of the unconditional model, expectations and therapeutic alliance main effect model and interactive effects model of expectations and therapeutic alliance by follow-ups for fear subscale

Fixed model effects	BAT at the last follow up		BAT change during follow up	
	γ	*SE*	γ	*SE*
Time as only predictor model				
Intercept	4.31*	1.32	− 0.20	0.11***
Conditional effects model				
Intercept	4.24**	1.35	− 0.24**	0.11
Treatment expectations	− 0.20	0.35	0	0.09
Therapeutic alliance	− 0.03	0.73	− 0.25	0.19
Treatment condition	0.24	0.26	0.55**	0.22
Interactive effects model				
Intercept	4.53*	1.37	− 0.32*	0.12
Therapeutic alliance	− 0.02	0.74	− 0.17	0.19
Treatment expectations	− 0.17	0.36	0.04	0.09
Treatment condition	0.23	0.85	0.52**	0.22
Therapeutic alliance × treatment expectations	0.02	0.43	0.20***	0.11

We only reported the fixed effects model for the Main Effects of Expectations and Therapeutic alliance, as it was selected as the final model. Treatment = IVE

*$p < .01$, **$p < .05$, ***$p < .10$

Table 3 Results of the unconditional model, expectations and therapeutic alliance main effect model and interactive effects model of expectations and therapeutic alliance by follow-ups for avoidance subscale

Fixed model effects	BAT at the last follow up		BAT change during follow up	
	γ	*SE*	γ	*SE*
Time as only predictor model				
Intercept for avoidance	2.82	1.79	− 0.22	0.19
Conditional effects model				
Intercept	1.97	1.75	− 0.21***	0.13
Therapeutic alliance	0.02	0.85	0.01	0.21
Treatment expectations	− 0.74***	0.40	0.01	0.10
Treatment condition	0.30	1.00	0.55**	0.25
Interactive effects model				
Intercept	1.71	1.75	− 0.30**	13
Therapeutic alliance	0.19	0.87	0.12	0.22
Treatment expectations	− 0.67	0.41	0.07	0.10
Treatment condition	0.24	1.00	0.51**	0.25
Therapeutic alliance × treatment expectations	0.36	0.50	0.25**	0.13

We only reported the fixed effects model for the Main Effects of Expectations and Therapeutic alliance, as it was selected as the final model. Treatment = IVE

**$p < .05$, ***$p < .10$

Table 4 Results of the unconditional model, expectations and therapeutic alliance main effect model and interactive effects model of expectations and therapeutic alliance by follow-ups for beliefs subscale

Fixed model effects	BAT at the last follow up		BAT change during follow up	
	γ	*SE*	γ	*SE*
Time as only predictor model				
Intercept for beliefs	2.34*	1.12	− 0.19	0.10***
Conditional effects model				
Intercept	2.08**	1.07	− 0.15	0.11
Therapeutic alliance	0.51	0.85	0.06	0.09
Treatment expectations	− 0.95**	0.33	− 0.05	0.9
Treatment condition	0.38	0.82	0.20	0.22
Interactive effects model				
Intercept	1.91***	1.10	− 0.23**	0.12
Therapeutic alliance	0.68	0.72	0.16	0.20
Treatment expectations	− 0.81**	0.34	− 0.00	0.10
Treatment condition	0.68	0.72	0.17	0.22
Therapeutic alliance × treatment expectations	0.57	0.41	0.23**	0.11

We only reported the fixed effects model for the Main Effects of Expectations and Therapeutic alliance, as it was selected as the final model. Treatment = IVE

*$p < .01$, **$p < .05$, ***$p < .10$

In the models with the fear subscale, we didn't find a significant effect of the alliance on the last follow up score ($\gamma_{01} = -0.03$, $SE = 0.73$, 95% CI [− 1.46, 1.40], $t(141) = -0.04$, $p = .97$) nor of expectations ($\gamma_{02} = -0.20$, $SE = 0.35$, 95% CI [− 0.89, 0.49], $t(133) = -0.56$, $p = .57$). Furthermore, we neither found a significant effect of alliance ($\gamma_{11} = -0.25$, $SE = 0.19$, 95% CI [− 0.62, 0.12], $t(168) = -1.35$, $p = .18$) nor expectations ($\gamma_{12} = -0$, $SE = 0.09$, 95% CI [− 0.18, 0.17], $t(168) = -0.04$, $p = .97$) on the slope of the fear subscale.

In the models with the avoidance subscale, we did not find a significant effect of the alliance ($\gamma_{01} = 0.02$, $SE = 0.84$, 95% CI [− 1.64, 1.69], $t(134) = 0.03$, $p = .98$) but we did find an approach significant effect of expectations on the last follow up score ($\gamma_{02} = -0.74$, $SE = 0.40$, 95% CI [− 1.52, 0.04], $t(13) = -1.88$, $p = .06$). Furthermore we did neither find a significant effect of alliance ($\gamma_{11} = -0.25$, $SE = 0.19$, 95% CI [− 0.62, 0.12], $t(168) = -1.35$, $p = .18$) nor expectations ($\gamma_{12} = -0$, $SE = 0.09$, 95% CI [− 0.18, 0.17], $t(168) = -0.04$, $p = .98$) on the slope of the avoidance subscale.

In the models with the belief subscales, we did not find a significant effect of the alliance, $\gamma_{01} = 0.42$, $SE = 0.70$, 95% CI [− 0.95, 1.80], $t(153) = 0.61$, $p = .55$ but we did find a significant effect of expectations on the last follow up score, $\gamma_{02} = -0.94$, $SE = 0.33$, 95% CI [− 1.45. − 0.35], $t(153) = -2.88$, $p < .01$ on this specific dimension. Moreover, we did neither find a significant effect of alliance ($\gamma_{11} = 0.06$, $SE = 0.19$, 95% CI [− 0.31, 0.43], $t(168) = 0.33$, $p = .74$) nor expectations ($\gamma_{12} = -0.05$, $SE = 0.09$, 95% CI [− 0.23, 0.12], $t(168) = -0.60$, $p = .55$) on the slope of the belief subscale.

Interactional Models

Interactive Effect Model of Therapeutic Alliance and Treatment Expectation

Interactional models for fear did not show a significant interactive effect of alliance by expectations neither on the fear subscales' last follow-up score ($\gamma_{03} = 0.02$, $SE = 0.43$, 95% CI [− 0.82, 0.87], $t(140) = 0.05$, $p = .99$) nor on the slope ($\gamma_{13} = 0.20$, $SE = 0.11$, 95% CI [− 0.02, 0.41], $t(168) = 1.76$, $p = .08$).

Interactional models for avoidance did not show significant interactive effects of alliance and expectations on the avoidance subscales' last follow up score ($\gamma_{03} = 0.36$, $SE = 0.50$, 95% CI − 0.64, 1.35], $t(131) = 0.71$, $p = .48$) but it did on the slope ($\gamma_{13} = 0.25$, $SE = 0.11$, 95% CI [− 0.02, 0.41], $t(168) = 1.98$, $p < .05$).

Interactional models for beliefs did not show significant interactive effects on the belief subscales' last

follow up ($\gamma_{03} = 0.57$, $SE = 0.41$, 95% CI [− 0.25, 1.38], $t(152) = 1.38$, $p = .17$) but it did on the slope ($\gamma_{13} = 0.23$, $SE = 0.11$, 95% CI [0.01, 0.45], $t(168) = 2.07$, $p < .05$).

Discussion

The goal of the present study was to investigate the effects of the therapeutic alliance and treatment expectations on exposure treatment outcomes. We analyzed (1) the effects of the therapeutic alliance on treatment outcome, (2) the effects of treatment expectations on treatment outcome, and (3) the interaction between both variables on treatment outcome.

Contrary to hypothesis one, results indicate that the therapeutic alliance is not a direct predictor of treatment outcome for SP. In accordance with hypothesis two, treatment expectations meaningfully predicted beliefs and avoidance symptoms related to SP. With regard to hypothesis three, there was no interaction effect of treatment expectations and the therapeutic alliance on symptom scores over follow-up.

With regard to the therapeutic alliance, our results suggest that it is not a significant predictor of symptom change in a one-session exposure treatment for SP. Our findings are in line with other studies on anxiety disorders that measured the therapeutic alliance and found no significant alliance-outcome relationship (e.g., Maiwald et al., 2019). It might be that the alliance is not equally important in the treatment of this diagnostic group as it is for other mental disorders. Our results, however, are not in line with the findings by Buchholz and Abramowitz (2020) and Pan et al. (2011) who presented the alliance as a possible estimator of treatment outcome in a one-session exposure for SP. Specifically, the authors found that the therapeutic alliance had an effect on avoidance symptoms (Pan et al., 2011). Moreover, as the quality of the therapeutic alliance can vary over time, differences in results may depend on the moment of assessment. In the study conducted by Pan et al. (2011), the alliance was assessed immediately following treatment, and by a blind observer after viewing a videotape of the therapy session. This is an important distinction considering that in the present study the therapeutic alliance was completed by the patient in the first session prior to the intervention. The non-significant alliance outcome association in our findings may be related to this. Moreover, different variables such as adherence to treatment, self-efficacy, cognitive change, and motivation can mediate the relationship between the therapeutic alliance and treatment outcomes which can lead to a discrepancy (Böhnlein et al., 2019; Buchholz & Abramowitz, 2020). Another issue that may have influenced the non-significant alliance results is the fact that treatments were provided by 5 different therapists. Results may benefit from including the therapist's effect on the analysis regarding evaluations of therapeutic alliance, which wasn't included in this study.

With regard to treatment expectations, positive expectancies of patients enhanced the improvement of symptoms which is in line with Price et al. (2008) findings. Moreover, results suggest that expectancies are equally important in IVE as in ARE. Effects of expectancies on beliefs and avoidance symptoms are likely to be related to the fact that confidence in the treatment may produce a change in cognition. Considering cognitive-behavioral theory, changes in beliefs would help the patient to feel more capable, comfortable, and with a greater sense of personal competence when coping with fear versus avoiding it (Beck et al., 1979). Moreover, these results correspond with the idea of transforming cognitions to help the patient confront the anxiety activated by the phobic object.

Finally, the lack of interaction between expectations and the therapeutic alliance is likely related to the fact that the alliance alone was not a significant predictor of change.

There are several limitations to bear in mind when interpreting our results. Since this was a study with a one-session treatment, results in other types of treatments could vary. Also, therapeutic alliance and expectations were measured at baseline as predictors of outcomes. This is important considering that the therapeutic alliance was assessed only prior to the intervention and in that sense differs from previous studies. Including an assessment of the therapeutic alliance after the intervention could provide useful additional information, as several assessments of the predictors over time may lead to divergent results. Finally, because of the size of the sample, the focus on a specific subtype of SP, and the previously mentioned limitations such as lack of information on previous treatments, the generalizability of our results is limited.

Further research is necessary to address the outlined limitations. More process-outcome studies for patients with SP will help to understand the relational change mechanisms involved in different exposure treatments. Also, we need to consider that technology is continuously developing and evolving, graphics and designs in AR improves which may add value to the exposure devices and as a consequence influence new treatments. Also, the present research was based on one session of exposure treatment that turned out to be long. We recommend taking breaks during the session if it is prolonged.

Overall, the results of this study suggest that expectations have a meaningful effect on outcomes in exposure-based treatments, both in IVE and ARE. This underlines the importance for therapists to consider and foster positive expectations regardless of the type of exposure they work with.

Funding This study was funded by the Ministry of Economy and Competitiveness (Spain), (Plan Nacional I + D + I. PSI2010-17563), and the Institute of Health Carlos III (ISCiii). CIBERobn is an initiative of ISCIII. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Declarations

Conflict of interest Malenka Areas, Anna Margarete Babl, Javier Fernández-Álvarez, Andrés Roussos, Cristina Botella, Azucena García-Palacios, Rosa Baños, Soledad Quero, Juana María Breton and Juan Martín Gómez Penedo declare that they have no conflict of interest.

Ethical Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethical Committee of the Jaume I University (Comisión Deontológica de la Universitat Jaume I) in January 2011. The study was based on a Randomised Control Trial (RCT) [Main outcome paper (Botella et al., 2016)]. It was registered in the National Institute of Health Registration System (http://www.clinicaltrials.gov) with Clinical Trials Registration Number: NCT01361074.

Animal Rights No animal studies were carried out by the authors for this article.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to Publish Patients signed informed consent regarding publishing their data.

References

Abramowitz, J. S., Deacon, B. J., & Whiteside, S. P. H. (2019). *Exposure therapy for anxiety* (2nd ed.). Guilford Publications.

Baños, R. M., Botella, C., Guillen, V., García-Palacios, A., Quero, S., Bretón-López, J., & Alcañiz, M. (2009). An adaptive display to treat stress-related disorders: EMMA's World. *British Journal Guidance Counselling, 37*(3), 347–356. https://doi.org/10.1080/03069880902957064

Beck, A., Rush, A., Shaw, B., & Emery, G. (1979). *Cognitive therapy of depression*. Guilford Press.

Böhnlein, J., Altegoer, L., Muck, N. K., Roesmann, K., Redlich, R., Dannlowski, U., & Leehr, E. J. (2019). Factors influencing the success of exposure therapy for specific phobia: A systematic review. *Neuroscience and Biobehavioral Reviews, 108*, 796–820. https://doi.org/10.1016/j.neubiorev.2019.12.009

Bordin, E. S. (1979). The generalizability of the psychoanalytic concept of the working alliance. *Psychotherapy Theory Research Practice Training, 16*(3), 252–260. https://doi.org/10.1037/h0085885

Borkovec, T. D., & Nau, S. D. (1972). Credibility of analogue therapy rationales. *Journal of Behavioural Therapy Experimental Psychiatry, 3*(4), 257–260. https://doi.org/10.1016/0005-7916(72)90045-6

Botella, C., Baños, R., Villa, H., Perpiñá, C., & García-Palacios, A. (2000). Virtual reality in the treatment of claustrophobic fear: A controlled, multiple-baseline design. *Behavior Therapy, 31*(3), 583–595. https://doi.org/10.1016/S0005-7894(00)80032-5

Botella, C., Fernández-Álvarez, J., Guillén, V., García-Palacios, A., & Baños, R. (2017). Recent progress in virtual reality exposure therapy for phobias: A systematic review. *Current Psychiatry Reports, 19*(7), 1–13. https://doi.org/10.1007/s11920-017-0788-4

Botella, C., García-Palacios, A., Villa, H., Baños, R. M., Quero, S., Alcañiz, M., & Riva, G. (2007). Virtual reality exposure in the treatment of panic disorder and agoraphobia: A controlled study. *Clinical Psychology & Psychotherapy, 14*(3), 164–175. https://doi.org/10.1002/cpp.524

Botella, C., Pérez-Ara, M. Á., Bretón-López, J., Quero, S., García-Palacios, A., & Baños, R. M. (2016). In vivo versus augmented reality exposure in the treatment of small animal phobia: A randomized controlled trial. *PLoS ONE, 11*(2), e0148237. https://doi.org/10.1371/journal.pone.0148237

Bretón-López, J., Tortella-Feliu, M., del Amo, A. R., Baños, R., Llabrés, J., Gelabert, J. M., & Botella, C. (2015). Patients' preferences regarding three computer-based exposure treatments for Fear of Flying. *Behavioural Psychology, 23*(2), 265–285.

Buchholz, J. L., & Abramowitz, J. S. (2020). The therapeutic alliance in exposure therapy for anxiety-related disorders: A critical review. *Journal of Anxiety Disorders, 70*, e102194. https://doi.org/10.1016/j.janxdis.2020.102194

Constantino, M. J., Vîslă, A., Coyne, A. E., & Boswell, J. F. (2018). A meta-analysis of the association between patients' early treatment outcome expectation and their posttreatment outcomes. *Psychotherapy, 55*(4), 473–485. https://doi.org/10.1037/pst0000169

Corbella, S., & Botella, L. (2003). La alianza terapéutica: historia, investigación y evaluación [versión electrónica]. *Revista Anales De Psicología, 2*(19), 205–221.

Eaton, W. W., Bienvenue, O. J., & Miloyan, B. (2018). Specific phobias. *Lancet Psychiatry, 5*(8), 678–686. https://doi.org/10.1016/S2215-0366(18)30169-X

Emmelkamp, P. M., & Meyerbröker, K. (2021). Virtual reality therapy in mental health. *Annual Review of Clinical Psychology, 17*, 495–519. https://doi.org/10.1146/annurev-clinpsy-081219-115923

Fernández-Álvarez, J., Di Lernia, D., & Riva, G. (2020). Virtual reality for anxiety disorders: rethinking a field in expansion. In Y. K. Kim (Ed.), *Anxiety disorders. Advances in experimental medicine and biology.* . Springer. https://doi.org/10.1007/978-981-32-9705-0_21

Flückiger, C., Del Re, A. C., Wampold, B. E., & Horvath, A. O. (2018). The alliance in adult psychotherapy: A meta-analytic synthesis. *Psychotherapy, 55*(4), 316–340. https://doi.org/10.1037/pst0000172

Garcia-Palacios, A., Hoffman, H., Carlin, A., Furness, T., & Botella, C. (2002). Virtual reality in the treatment of spider phobia: A controlled study. *Behaviour Research and Therapy, 40*(9), 983–993. https://doi.org/10.1016/s0005-7967(01)00068-7

Gómez Penedo, J. M., Muiños, R., Hirsch, P., & y Roussos, A. (2019). La aplicación de modelos lineales jerárquicos para el estudio de la eficacia en psicoterapia. *Revista Argentina De Ciencias Del Comportamiento, 11*(1), 25–37. https://doi.org/10.32348/1852.4206.v11.n1.20412

Hagen, K., Solem, S., Opstad, H. B., Vogel, P. A., Ottesen Kennair, L. E., Kvale, G., & Hansen, B. (2016). Therapist variability in the task/goal dimension of the early working alliance predicts outcome in exposure and response prevention treatment for obsessive-compulsive disorder. *Clinical Neuropsychiatry, 13*(6), 94–99.

Hazlett-Stevens, H., & Craske, M. G. (2009). Live (in vivo) exposure. In W. T. O'Donohue & J. E. Fisher (Eds.), *General principles and empirically supported techniques of cognitive behavior therapy* (pp. 407–414). Wiley.

Kaczkurkin, A. N., & Foa, E. B. (2015). Cognitive-behavioral therapy for anxiety disorders: An update on the empirical evidence. *Dialogues in Clinical Neuroscience, 17*(3), 337–346. https://doi.org/10.31887/dcns.2015.17.3/akaczkurkin

Leehr, E. J., Roesmann, K., Böhnlein, J., Dannlowski, U., Gathmann, B., Herrmann, M. J., Junghöfer, M., Schwarzmeier, H., Seeger, F. R., Siminski, N., Straube, T., Lueken, U., & Hilbert, K. (2021). Clinical predictors of treatment response towards exposure

therapy in virtuo in spider phobia: A machine learning and external cross-validation approach. *Journal of Anxiety Disorders, 83*, 102448. https://doi.org/10.1016/j.janxdis.2021.102448

Levy, F., Leboucher, P., Rautureau, G., & Jouvent, R. (2016). E-virtual reality exposure therapy in acrophobia: A pilot study. *Journal of Telemedicine and Telecare, 22*(4), 215–220.

Maiwald, L. M., Junga, Y. M., Lang, T., Montini, R., Witthöft, M., Heider, J., Schröder, A., & Weck, F. (2019). The role of therapist and patient in-session behavior for treatment outcome in exposure-based cognitive behavioral therapy for panic disorder with agoraphobia. *Journal of Clinical Psychology, 75*(4), 614–626. https://doi.org/10.1002/jclp.22738

Maltby, N., Kirsch, I., Mayers, M., & Allen, G. (2002). Virtual reality exposure therapy for the treatment of fear of flying: A controlled investigation. *Journal of Consulting and Clinical Psychology, 70*(5), 1112–1118. https://doi.org/10.1037/0022-006X.70.5.1112

Maples-Keller, J. L., Yasinski, C., Manjin, N., & Rothbaum, B. O. (2017). Virtual reality-enhanced extinction of phobias and post-traumatic stress. *Neurotherapeutics, 14*(3), 554–563. https://doi.org/10.1007/s13311-017-0534-y

Meyerbroker, K., & Emmelkamp, P. M. (2008). Therapeutic processes in virtual reality exposure therapy: The role of cognitions and the therapeutic alliance. *Journal of CyberTherapy and Rehabilitation, 1*(3), 247–258.

Öst, L. G., Salkovskis, P. M., & Hellström, K. (1991). One-session therapist-directed exposure vs. self-exposure in the treatment of spider phobia. *Behavioural Therapy, 22*(3), 407–422. https://doi.org/10.1016/S0005-7894(05)80374-0

Pan, D., Huey, S. J., & Hernandez, D. (2011). Culturally-adapted versus standard exposure treatment for phobic Asian Americans: Treatment efficacy, moderators, and predictors. *Cultural Diversity & Ethnic Minority Psychology, 17*(1), 11–22. https://doi.org/10.1037/a0022534

Price, M., Anderson, P., Henrich, C. C., & Rothbaum, B. O. (2008). Greater expectations: Using hierarchical linear modeling to examine expectancy for treatment outcome as a predictor of treatment response. *Behavioural Therapy, 39*(4), 398–405. https://doi.org/10.1016/j.beth.2007.12.002

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publications Inc.

Rothbaum, B., Anderson, P., Zimand, E., Hodges, L., Lang, D., & Wilson, J. (2006). Virtual reality exposure therapy and standard (in vivo) exposure therapy in the treatment of fear of flying. *Behavioral Therapy, 37*(1), 80–90. https://doi.org/10.1016/j.beth.2005.04.004

Shiban, Y., Diemer, J., Müller, J., Brütting-schick, J., Pauli, P., & Mühlberger, A. (2017). Diaphragmatic breathing during virtual reality exposure therapy for aviophobia: Functional coping strategy or avoidance behavior? A pilot study. *BMC Psychiatry, 17*, 1–10. https://doi.org/10.1186/s12888-016-1181-2

Totzeck, C., Teismann, T., Hofmann, S. G., von Brachel, U., Zhan, X. C., Pflug, V., & Margraf, J. (2019). Effective styles in panic disorder and specific phobia: Changes through cognitive behavior therapy and prediction of remission. *Behaviour Therapy, 51*(3), 375–385. https://doi.org/10.1016/j.beth.2019.06.006

Wechsler, T. F., Kümpers, F., & Mühlberger, A. (2019). Inferiority or even superiority of virtual reality exposure therapy in phobias?—A systematic review and quantitative meta-analysis on randomized controlled trials specifically comparing the efficacy of virtual reality exposure to gold standard in vivo exposure in agoraphobia, specific phobia, and social phobia. *Frontiers in Psychology, 10*, 01758. https://doi.org/10.3389/fpsyg.2019.01758

Weck, F., Richtberg, S., Jakob, M., Neng, J. M. B., & Höfling, V. (2015). Therapist competence and therapeutic alliance are important in the treatment of health anxiety (hypochondriasis). *Psychiatry Research, 228*(1), 53–58. https://doi.org/10.1016/j.psychres.2015.03.042

Wheaton, M., Huppert, J., Foa, E. B., & Simpson, H. B. (2016). How important is the therapeutic alliance in treating obsessive-compulsive disorder with exposure and response prevention? *An Empirical Report, 13*, 88–93.

Wiederhold, B. & Bouchard, S. (2014). Claustrophobia: efficacy and treatment protocols. In *Advances in virtual reality and anxiety disorders. series in anxiety and related disorders.* Springer. https://doi.org/10.1007/978-1-4899-8023-6_7

Wrzesien, M., Botella, C., Breton-Lopez, J., del Rio Gonzalez, E., Burkhardt, J. M., Alcañiz, M., & Angeles Perez-Ara, M. (2015). Treating small animal phobias using a projective-augmented reality system: A single-case study. *Computers in Human Behavior, 49*, 343–353. https://doi.org/10.1016/j.chb.2015.01.065

Wrzesien, M., Burkhardt, J. M., Botella, C., & Alcañiz, R. L. M. (2012). Evaluation of the quality of collaboration between the client and the therapist in phobia treatments. *Interacting with Computers, 24*(6), 461–471. https://doi.org/10.1016/j.intcom.2012.09.001

Wu, M. S., Caporino, N. E., Peris, T. S., Pérez, J., Thamrin, H., Albano, A. M., Kendall, P. C., Walkup, J. T., Birmaher, B., Compton, S. N., & Piacentini, J. (2020). The Impact of Treatment Expectations on Exposure Process and Treatment Outcome in Childhood Anxiety Disorders. *Research on Child and Adolescent Psychopathology, 48*, 79–89. https://doi.org/10.1007/s10802-019-00574-x