



CASE REPORT

Acrophobia treatment with virtual reality assisted acceptance and commitment therapy: case reports

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ABSTRACT

Exposure has an essential place in the treatment of acrophobia and technology may increase the success of exposure therapies in many ways. We predicted that the integration of Acceptance and Commitment Therapy (ACT) with Virtual Reality (VR) technology would be beneficial in the treatment of acrophobia and would improve clients' compliance with therapy. This report presents two examples of VR assisted ACT treatment for acrophobia. The process consists of six sessions (one initial interview and five sessions of interventions) for individual therapy. In the first two sessions, functional behavioral analysis and case formulation performed with clients and skills taught to use during exposure sessions. From the second session, VR assisted exposure interventions began to apply with ACT principles. Results showed an expressive improvement for both of the clients. Both clients could complete the virtual behavioral approach task at the end of the treatment, present decreased avoidance strategies and increased value-based behaviors. VR assisted ACT is promising, especially to facilitate exposure treatments.

Keywords: Acrophobia, acceptance and commitment therapy, exposure, virtual reality

INTRODUCTION

Acrophobia, which is an extreme fear of heights, is a specific phobia of naturalistic type. It is the most common type of specific phobia affecting men, and the second or third most common type in women (1). While physiological visual height imbalance in fearful environments and situations such as towers, staircases, bridges, cliffs or mountain ridges may affect 100 % of people (2), individuals with acrophobia react differently. Although the incidence is high in the community, only a small percentage of affected people seek professional help (3).

Most studies and reviews published in recent years emphasize that cognitive & behavioral therapies are the

most effective methods in the treatment of specific phobias and also acrophobia (2). A recent meta-analysis composed of 16 studies compared five broad categories of intervention: desensitization (DS); in vivo exposure (IVE); virtual reality exposure (VRE); neurolinguistics programming (NLP) and VRE with medication. There is empirical research demonstrating the effectiveness of IVE, DS and VRE in the short term (4).

VRE is used in a wide range of psychotherapy treatments including PTSD, anxiety disorders (5), psychotic disorders (6), substance use disorders and eating disorders (7). Rothbaum et al., for the first time in 1995, demonstrated the efficacy of virtual reality exposure therapy (VRET) in acrophobia (8). VRET can successfully reveal fear and anxiety, saves time and

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money by allowing us to have a session in the therapy room. It also provides a safer environment for clients by removing risks such as security and shame that may arise in the public areas for the client. With these advantages, rejection of treatment by clients is decreasing (9).

Acceptance and Commitment Therapy (ACT) is a form of cognitive-behavioral therapies and has a growing evidence for the treatment of broad clinical problems. A review published in 2014 showed that ACT has moderate evidence for mixed anxiety disorders, Generalized Anxiety Disorder (GAD), Obsessive Compulsive Disorder (OCD), and social phobia (10). Although there is no controlled study in the field of specific phobia interventions with ACT, to date there is only one laboratory-based study of ACT use in spider phobia. It was found that the ACT group was able to go further and more voluntarily to perform the same procedure the following week (11). In this article, VR-assisted ACT process of two cases with acrophobia will be explained in detail and the findings will be discussed in the light of the literature.

CASE

Participants and Therapists

Two clients suffering from acrophobia participated in the therapy. They both met the DSM-5 criteria for the diagnosis of acrophobia. Clients' level of acrophobia was assessed and confirmed by clinical interview. The clients' names were changed to protect their privacy and both signed an informed consent form.

Therapists (first two authors) are practicing as psychiatrists (MD) in a mental hospital. All therapists are trained in ACT and supervised by an ACT trainer and supervisor (third author).

Technical Equipment and Software

The VR equipment consists of an Oculus Rift Virtual Reality headset and Oculus Touch Controllers (<http://www.oculus.com>). "Safemind" is Virtual Reality based anxiety and phobia treatment platform for mental health professionals, that enables implement exposure therapy to their treatment sessions (www.safemind.app).

Measures

The Acceptance and Action Questionnaire-II (AAQ-II) assesses the differences in experiential avoidance and psychological inflexibility among individuals. It's a 7-point (1 never true, 7 always true) Likert type self-

report scale and higher levels indicate higher levels of experiential avoidance and psychological rigidity (12). The Turkish validity and reliability study of the AAQ-II was performed by Yavuz et al (13).

Simulator Sickness Questionnaire (SSQ) is a 16-item self-report questionnaire (14). The SSQ measures cybersickness symptoms like nausea, oculomotor disturbances, and disorientation in the context of simulation (15). It is the most commonly used scale of simulator sickness.

The Acrophobia Assessment Questionnaire (AcAQ) is developed from the Fear Questionnaire (FQ) (16) to evaluate height-related avoidance, disturbing and accompanying symptoms. The Acrophobia Assessment Questionnaire specifically developed by the authors according to acrophobia and consists of three 8-point Likert type subscales (for avoidance, disturbing, and accompanying symptoms)

The Igroup Presence Questionnaire (IPQ) is a 14-item 5-point Likert style self-report measure. IPQ was developed to measure the sense of presence experienced in the context of simulation (17) and consists of three subscales (Spatial Presence: the sense of being physically present, Involvement: measuring the involvement level, Experienced Realism: measuring the subjective experience of realism) and an additional item for measuring global presence not loaded into subscales (17,18).

A Subjective Units of Distress Scale (SUDS) assesses the level of disturbance or distress currently experienced. SUDS is a self-report scale and the individuals report their current anxiety between 0 (no distress) and 100 (highest distress) (19). In this study as a measure of experienced anxiety, the SUDS was used in every session.

A Subjective Units of Willingness (SUWS) is a self-report scale, assesses the level of willingness to experience difficult thoughts and feelings. A visual analog scale prepared by authors for the assessment of state willingness. The individuals report their current openness/acceptance between 0 and 100. Willingness levels are assessed in every session throughout the therapy.

The Acrophobia Questionnaire (AQ) is a 40-items self-report scale assesses individuals' anxiety and avoidance levels associated with 20 height-relevant situations (20). For the needs of current study, only 20 items of AQ which related to the anxiety level were used.

Behavioral Approach Test (BAT) is an objective measure to evaluate how close the participant is to the

feared object or situation. With BAT, it is possible to measure both the severity of the phobia and the effectiveness of the therapy (21). Besides, there is no standard BAT application (22). While BAT generally used in real environment, there are also studies that it used in the virtual environment (2,23). In this study, we used Virtual Reality Behavior Avoidance Test (VR-BAT). In our cases, we asked our clients to go up with the outdoor elevator to the highest floor of a skyscraper in virtual environment and we have calculated the tolerated maximum ascent time and height. Clients did VR-BAT at the pre-treatment (initial interview) session and at the end of the 5th session.

Program Overview

Including an initial interview, a total of six sessions were planned. On a weekly basis, the duration of each session was 45 minutes. Initial interviews were conducted for assessment. The clients were informed about the virtual reality assisted ACT for acrophobia and their signed informed consent was obtained. Detailed content of every session showed in Table 1.

Case 1

A 29-year-old female medical doctor applied to our clinic for height phobia. Her fear of height was present from a young age. She could not play with the rising machines when she went to the amusement park in primary school. In high places -especially when there were no balustrades in between- there was a feeling of fear, anxiety and unrest; at that time, she thought that she could fall and die, and then she had stepped back and sometimes screamed. If there was no barrier, she could not look down from the balcony of the second floor. If there was a barrier, on the third floor balcony, she could stand one step back from the edge; on the 5th and 6th floors, she could only keep his back against the back wall. She could go on touristic attractions with his friends, but she could not go to high places. Although this problem did not cause negative consequences in interpersonal relations, reduced the quality of her life. The client met the 'height phobia' criteria of DSM 5 according to clinical interview and no comorbid psychiatric disorder was found. She could not complete BAT and stopped the elevator in 20 seconds (approximately 35 feet).

In the first session, 'ACT matrix' (24) was used to formulate the client's problem. Behaving a brave person, participating in exciting activities and freedom were identified as values related with height phobia.

The client wants bungee jump, sky parachute and participate in similar activities, but says she avoids these situations because of she keeps experiencing many unwanted emotions, sensations and thoughts every time she tries to engage in them. After working on establishing willingness, it was then discussed how to deal with unwanted private experiences in high places.

The client then entered a scene in the virtual environment, a terrace of a high building. While she approached the edge of the terrace; tension, trembling in the hands and desire to escape emerged. She was taught grounding and acceptance of emotions instead of escape when she felt anxiety. Daily grounding and acceptance exercises planned between sessions. VR assisted exposure was started to apply in session 2. In this session, it was realized that she was waiting for the uncomfortable feelings to end in order to get higher. At the beginning of the 3rd session creative hopelessness was intervened once again. Afterwards it seems that willingness to experience uncomfortable feelings on the elevator has increased. VRET was applied in the 3rd, 4th and 5th sessions. At the end of the 5th session, she could reach the highest point by elevator in virtual environment, so she completed the BAT. Within the period of therapy she also moved to a higher-rise house and listened to a concert on the third floor with her friend. She told that also had fun as she desired when attended to concert.

Case 2

A 45-year-old Turkish female gynecologist with her own private practice. She resides in Istanbul with her husband and three children. She recalls that her acrophobia began when she was driving a car thirteen years ago. The spaces she feared most were high bridges on main roads; high rise buildings; steep hills; and wide-open fields. She especially could not look down below once she reached the 6th floor of a building. In those situations, she recalls feeling very intense fear and anxiety. For 13 years, her complaints have been increasing and decreasing from time to time. Currently, she still finds difficulties when ascending a building, crossing a high bridge alone, driving a car alone and boarding the plane without taking pills. Even if it is more far away she is trying to find ways without bridges or high places.

The client met the full criteria for DSM-5 'height phobia' via a clinical interview. She stayed for 21 seconds (approximately 37 feet) in the VR-BAT test, which was conducted in the initial interview. In the

Table 1: Content of sessions

	ACT key concepts	Purposes
Initial interview	<ul style="list-style-type: none"> -Introduction of VR assisted ACT therapy -Identifying ACT-consistent treatment alliances and goals 	<ul style="list-style-type: none"> -Informing the client about the therapy process. -Taking the client's history and establishing therapeutic relationship with the client. -Identifying ACT-consistent treatment goals. -Introduction of virtual reality equipment and how to use its headset. -Testing VR in a neutral scenario. -Implementation of the VR-BAT
1st session	<ul style="list-style-type: none"> -Using the ACT Matrix (24) for: <ul style="list-style-type: none"> • Identifying values • Identifying height-related private events (thoughts, emotions, bodily sensations) <ul style="list-style-type: none"> • "Control is the problem" • Creative hopelessness • Choosing a valued direction <ul style="list-style-type: none"> • Valued action -Learning new skills <ul style="list-style-type: none"> • Acceptance Grounding 	<ul style="list-style-type: none"> -Client identifies values and determines valued life directions. -Client learns to observe his private events -Client identifies his coping styles for these difficult private events -Client learns that the coping strategies he used are for controlling difficult private events. Therapist validates client's private events and struggle with them. - Client learns in a validated way that these strategies are impeding her life functioning. -Client experiences symptoms in virtual environment (virtual exposure) -Client learns acceptance and grounding, how to stay with discomfort, as an alternative to avoidance. -Client chooses to be open and willing to his difficult private events. He/she learns to move in a valued direction with them instead of avoidance. -Client experiences symptoms without avoidance behaviors (virtual exposure) -Client learns acceptance, how to stay with discomfort, as an alternative to avoidance. -Client learns to observe private events and chooses to be open and willing to experience them even if they are difficult for her. -Client learns to be directed by her values not by difficult private events.
2nd to 5th session	<ul style="list-style-type: none"> • Virtual Reality assisted Exposure (2nd session: 20 minutes, 3rd, 4th and 5th sessions: 30-35 min.) • Learning how to move with private events <ul style="list-style-type: none"> • Practicing new skills (applying acceptance, willingness, grounding and defusion to stay with discomfort) • Valued action 	<ul style="list-style-type: none"> -Client experiences symptoms without avoidance behaviors (virtual exposure) -Client learns acceptance, how to stay with discomfort, as an alternative to avoidance. -Client learns to observe private events and chooses to be open and willing to experience them even if they are difficult for her. -Client learns to be directed by her values not by difficult private events.

first session 'ACT matrix' (24) was performed to assess the state of the client through a functional approach. She had thoughts like "I'll fall", "it is not safe" and several self-critical thoughts like "why are you afraid?", "you always do that, why you cannot do?". She reported feeling a sense of inadequacy, intense fear, and anxiety including bodily sensations such as severe tachycardia, sweating, numbness below the knees, and difficulty in

breathing. The client identified the techniques she used to cope with these uncomfortable internal experiences (postpone plans, going from the long way, driving with someone next to the car). Creative hopelessness enabled the client to realize that the coping strategies she had used made her more desperate and tired. She also admitted that this state distances her from her values that remain important

for her to lead a meaningful life (freedom, self-improvement, seeing new places, helping people). Acceptance and grounding exercises allowed the client to realize that she could also move with painful private events and if she becomes open to experience these uncomfortable situations she could live according to her own needs and values rather than spending time trying to avoid them. She found defusion exercises particularly useful because it allowed her to notice self-critical thoughts that always respond to each other in her mind. In addition to increasing willingness and acceptance to experience her height-related bodily sensations and emotions, she said that being aware of critical thoughts, though not a direct target of therapy, helps her in other areas of her life. VRET was applied in the 3rd, 4th and 5th sessions. Although not given as homework, after the 3rd session, she drove a car alone and crossed the Bosphorus Bridge several times. At the end of the therapy, she completed VR-BAT and reached the highest point by elevator in a virtual environment. Even if her height-related anxiety symptoms were changing time to time, instead of delaying action until fear and anxiety eliminated she began to move towards her goals that were related to ensuring a meaningful life. She began to drive a car alone; organize trips with her family without obsessing over the height of the place they would pick; cross the high-bridges alone several times with her anxiety symptoms present.

Both of the clients had low points of SSQ, which shows that severity of cybersickness was very low. IPQ's three sub-scales assess the components of presence (17). Total IPQ scores decreased from 62 to 53 for case-1 and increased from 31 to 61 for case-2 at the end of the treatment. The higher scores of IPQ indicate a higher sense of presence (25).

SUDS (0–100) and willingness points (0–10) were taken before, every 3–5 minutes during, and at the end of the exposure. At the end of the treatment, both clients' SUDS points reduced, and willingness points increased. Also clients VR-BAT scores both increased at the end of the treatment. Both of the clients completed VR-BAT.

AcAQ evaluated separately for each subscale. After six months from the end of the treatment, level of avoidance score reduced from 4 to 2 for case-1 and from 7 to 4 for case-2 (Figure 1). Level of disturbing score also reduced from 7 to 2 for case-1 and from 6 to 5 for case-2 (Figure 2). Finally level of accompanying symptoms reduced from 27 to 6 for case-1 and from 35 to 18 for case-2 (Figure 3).

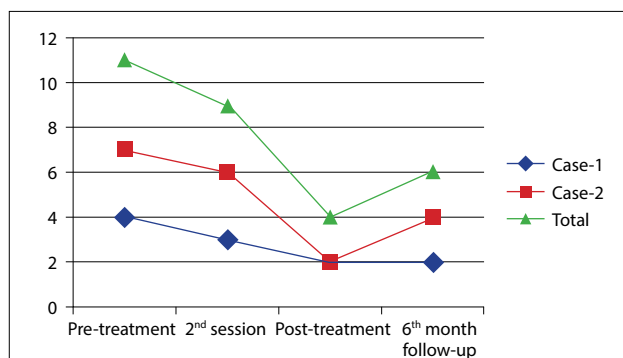


Figure 1. Changes in the avoidance sub-scale levels of The Acrophobia Assessment Questionnaire.

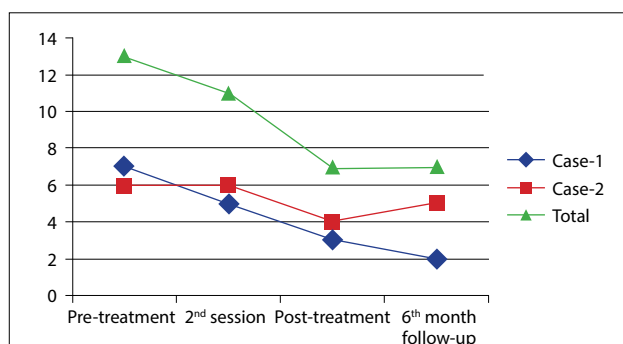


Figure 2. Changes in the disturbing sub-scale levels of The Acrophobia Assessment Questionnaire.

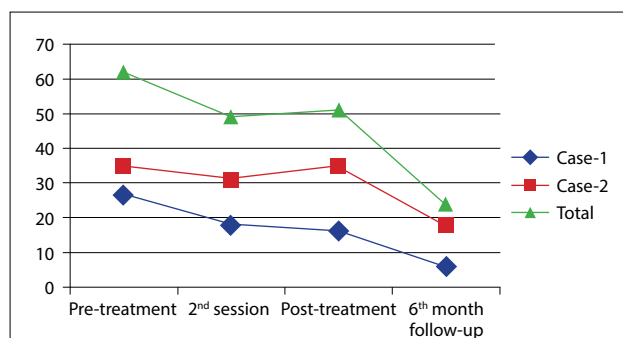


Figure 3. Changes in the accompanying symptoms sub-scale levels of The Acrophobia Assessment Questionnaire.

The course of anxiety sub-scores of AQ was different for each client. For case-1, AQ score was reduced from 46 to 12 after treatment and was 22 at six-month follow-up. For case-2 AQ score increased from 26 to 36 post-treatment and six-month follow-up AQ score was 37 (Figure 4).

The course of AAQ-II scores of clients was different from each other. For case-1, AAQ-II score decreased from 21 to 8, and for case-2 increased from 28 to 32 post-treatment and at the six-month follow-up decreased 28 again (Figure 5).

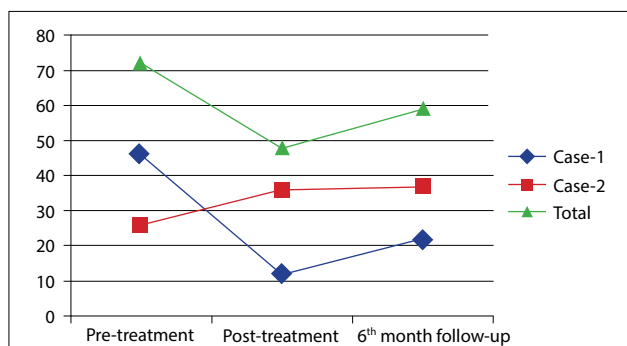


Figure 4. Changes in the anxiety sub-scores of The Acrophobia Questionnaire.

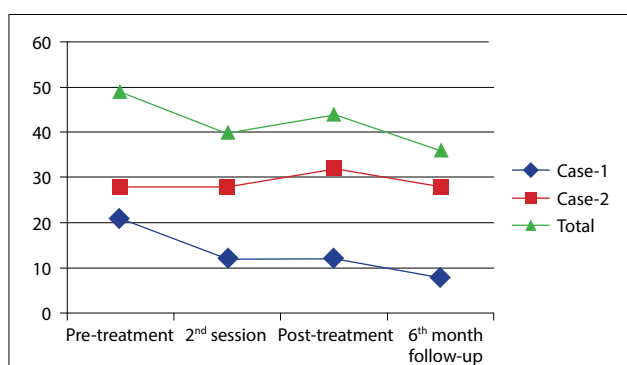


Figure 5. Changes in The Acceptance and Action Questionnaire-II.

DISCUSSION

Virtual reality is increasingly using in the theory development, assessment and treatment of various clinical conditions. The main areas of use are anxiety disorders, psychosis/schizophrenia, substance use disorders, eating disorders, and autistic spectrum disorders (26). There are also researches in the treatment of social cognition, social skills training, motor learning, verbal communication, phobias and attention deficit in the assessment of the autistic spectrum (27). This report aimed to show preliminary data of the effectiveness of Virtual Reality Assisted ACT program for acrophobia. In addition to effectiveness studies (28) there are many randomized controlled trials of ACT which include exposure techniques implemented in several diagnostic groups such as OCD (29), social anxiety (30), mixed anxiety groups, and findings suggested that ACT is an effective approach for exposure based interventions. However, there is a limited number of studies with ACT for specific phobias (11), and there is no previous research on the effectiveness of ACT for acrophobia as far as we can reach.

VR technology -used in the treatment of exposure in the last three decades- has increased its use and

prevalence both in treatment and psychopathology research. However, VR assisted ACT studies have just begun. At present, there is only one study conducted by Prudenzi et al (31) that applied a VR task for cognitive defusion to investigate the impact of VR on individuals' relations with a negative self-referential thought. They found that the VR assisted defusion intervention reduced the believability and negativity and increased comfort and willingness toward disturbing thoughts. This is the first report that involves ACT and VRET together.

From the ACT perspective, the purpose of exposure is to focus on acceptance of inner experiences rather than reduce or control them and to help the clients act in a more functional and flexible way toward their values (32). Contrary to traditional, habituation-based exposure methods, the ACT approach is not focused on fear reduction (32). ACT emphasizes helping clients live a valued life by accepting disturbing private events such as fear and anxiety rather than avoiding them. In the context of values, the function of fear and anxiety related stimuli are transformed, and the client becomes more open to aversive experiences (33). Following sessions in the light of these principles, although clients were able to reach respectively 35 and 37 feet before exposure, both of the clients achieved to complete VR-BAT at the end of the therapy (which means they have reached the highest point, approximately 212 feet). Additionally, these results were consistent with the clients' everyday life.

At the end of the treatment, the Acrophobia Assessment Questionnaire (AcAQ) level of avoidance and level of disturbance subscales scores decreased for both of the clients. At the six-month follow-up; both client's avoidance and disturbance levels remained the same or continued to decrease. While first client's psychological inflexibility score continued to decrease, the second client's psychological inflexibility score increased and then remained at the same level as the pre-treatment score. Likewise first client's anxiety level was lower compared to pre-treatment, the second client's anxiety level increased compared to pre-treatment assessment. Even though the anxiety level of the second case increased, her avoidant behaviors reduced, and value-oriented actions increased. From the ACT perspective, it can be said that, even in the presence of feared stimuli, the new actions (sharing with family, self-improvement) could be elicited when they connected with values. Through this process, clients willingly learn to acknowledge their anxiety symptoms and they do not try to suppress them. As a result, in ACT process it is not rare to see that anxiety symptoms still exist, however they lose their effect on clients' behaviors.

While AAQ-II total score of the first client's decreased during the therapy, the second client's score increased. Inconsistency between AAQ-II scores and behavioral measures in the second case may be due to the subjective feature of the AAQ-II. Another explanation could be that AAQ-II was designed for measuring general psychological inflexibility levels, not specific to acrophobia. Development of phobia specific psychological inflexibility measures may be more suitable for future studies.

Performing behavioral approach test (BAT) in a virtual environment may be a limitation for this study. However, there are some studies with successful data exist in which BAT performed in a virtual environment (2,23). Also our both clients' between session experiences were consistent with VR-BAT assessments. Further studies need to be done for real life and VR-BAT assessment comparisons. Another limitation; there is no Turkish validity and reliability study of the SSQ, AcaAQ, IPQ, SUDS, SUWS, AQ and BAT.

To conclude, ACT for acrophobia treatment with VR has been effective in reducing the height-related avoidance of clients and taking steps in line with their values in our cases. In the context of acrophobia, both client's valued based actions continued to increase at the six-month follow-up. Taken together these results indicate that effects of the therapy were still persist at the six-months follow up. However, it is necessary to expand the VR assisted ACT studies with RCTs to test these preliminary findings. New study designs are also needed in the treatment of height phobia to compare VR assisted ACT to other therapies assisted with VR. Performing additional studies that investigate the relation between VR-BAT and in vivo BAT would also be beneficial. Future studies should investigate evidence for the effectiveness of VR assisted ACT in specific phobias, particularly in acrophobia.

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Peer-review: Externally peer-reviewed.

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