Prolonged Exposure and Virtual Reality–Enhanced Imaginal Exposure for PTSD following a Terrorist Bulldozer Attack: A Case Study

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Abstract

In this case study, virtual reality was used to augment imaginal exposure in a protocol based on prolonged exposure. A 29-year-old male patient developed posttraumatic stress disorder after surviving a deadly terrorist bulldozer attack on two civilian buses and several cars in Jerusalem; the traumas witnessed by the survivor included a decapitation. The crowded bus in which the patient was riding was pushed over onto its side by the terrorist, injuring, trapping, and terrifying the passengers and causing gasoline to leak. Guided by his therapist, the patient entered an immersive computer-generated virtual world to go “back” to the scene of the traumatic event to help him gain access to his memories of the event, process and reduce the intensity of the emotions (fear/anger) associated with his pathological memories, and change unhealthy thought patterns. Traumatic memories of childhood abuse and traumatic memories of the bulldozer terrorist attack were treated using imaginal exposure while the patient was in the virtual environment BusWorld. The patient showed large posttreatment reductions in PTSD symptoms, and his Clinician-Administered PTSD Scale (CAPS) scores dropped from 79 pretreatment to zero immediately posttreatment, and CAPS was still at zero 6 months later. Although case studies are inconclusive by nature, these encouraging preliminary results suggest that further exploration of the use of virtual reality during modified prolonged exposure for PTSD is warranted. As terrorist attacks increase in frequency and severity worldwide, research is needed on how to minimize the psychological consequences of terrorism.

Introduction

A subset of people who experience a terrifying and potentially deadly physical or emotional incident develop chronic psychological problems such as posttraumatic stress disorder (PTSD). The incidence of developing PTSD following direct exposure to a terrorist attack is as high as 37.8%.1 People with PTSD commonly have persistent thoughts, memories, or nightmares about the traumatic event; have trouble sleeping; avoid thinking about the traumatic event; feel emotionally numb; and show social avoidance. Other common symptoms include recurring flashbacks, irritability, anger, rage, and hypervigilance. PTSD sufferers often systematically avoid memories and emotions associated with the traumatic event. Foa and Kozak2 theorize that avoidance perpetuates pathological memories of traumatic events and interferes with recovery. When used to treat PTSD, the core components of exposure therapy include having participants repeatedly self-generate, visualize, and describe their recollection of the traumatic event (imaginal exposure) and gradually exposing them repeatedly to fear-evoking, real-world situations or objects that remind them of their traumatic event (in vivo exposure).3 According to Foa and Kozak,2 the most effective exposure therapy involves eliciting a fear response as patients access their memory of the traumatic event. During therapy, while their memory of the traumatic event is activated and they are showing a fear response, patients process their emotions associated with the traumatic memory (e.g., via habituation). While their memory of the traumatic event is accessed, information incompatible with some of the pathological elements of memory is introduced. For example, instead of the erroneous belief that avoiding any thoughts

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associated with the traumatic event is their best coping strategy, patients may realize during therapy that gradually approaching and remembering the traumatic event will reduce their suffering in the long run. During therapy, a healthier memory is formed containing new elements. Patients develop more accurate metamorphic memories and retain fewer pathological beliefs. Exposure therapy is the most empirically supported intervention for PTSD and has a high treatment success rate for patients who complete treatment. Unfortunately, most people who have PTSD never seek treatment, and most people with PTSD who seek treatment never receive cognitive behavior therapy (CBT) involving exposure (e.g., prolonged exposure [PE]). Although large-scale efforts to increase dissemination are underway, CBT combined with exposure is not widely used by clinicians in the community who treat patients with PTSD. Several different exposure therapy protocols for treating PTSD have been developed and studied. In addition to the goal of improving outcome of completers, increasing patient and clinician acceptance and reducing treatment dropouts are important areas for future improvement.

People with PTSD fastidiously avoid thinking about their traumatic event. Getting them to imagine/self-generate images of their traumatic experience during therapy can be difficult. Patients often have exaggerated worries about what is going to happen if they allow themselves to access their traumatic memory (e.g., they will go crazy or have a heart attack). For some patients, pathological memories may be unusually difficult to access using imaginal exposure, limiting emotional processing. According to Foa and Kozak, situations that enhance fear evocation and habituation during therapy are expected to improve treatment outcome.

Virtual reality (VR) computer-generated simulations of traumatic events have been proposed as a means of facilitating a patient’s ability to visualize and remember a fear-provoking traumatic event in a gradual, controlled fashion. Instead of patients having to use great effort to self-generate images that help them gain access to their memories of traumatic events, the computer generates the images for them. Guided by their therapist, patients enter an immersive computer-generated virtual world that helps take them back to the scene of the traumatic event. With VR, patients experience gradually more realistic depictions of the terrorist attack they witnessed/experienced, to help them gain access to their memories of the event, process and reduce the intensity of the emotions (fear/anger/guilt) associated with their pathological memories (e.g., via habituation), and change unhealthy thought patterns. Graded exposure helps patients become more comfortable thinking about what happened with much less anxiety and less avoidant of remembering the traumatic events.

VR therapy for PTSD was first used in a case series by Rothbaum et al. to treat combat veterans. In the first study using VR to treat civilian PTSD, Difede and Hoffman developed a virtual environment that involves a graded immersive simulation the September 11, 2001, attack at the World Trade Center in Manhattan. In the first controlled study on VR exposure therapy for PTSD, nine out of the 10 VR exposure therapy patients showed a reduction in PTSD symptoms, seven patients no longer had PTSD after VR exposure therapy, and five who had previously failed to improve with traditional therapy showed 25% to 50% or more reductions in PTSD symptoms after completing therapy. These gains were maintained at 6-month follow-up. In contrast, all waiting-list control patients still had clinical PTSD at the end of the study. Further research on VR exposure therapy for PTSD is warranted by these encouraging preliminary results, and there are a growing number of patients needing treatment for PTSD. For example, tens of thousands of U.S. soldiers are returning from Iraq and Afghanistan with PTSD. As terrorist attacks increase in frequency and severity worldwide, research is needed on how to minimize the psychological consequences of terrorism.

Palestinians and Israelis have both been victims of traumatic events stemming from their violent conflict. Israeli civilians have been targeted in a number of Palestinian terrorist attacks. For example, in 2008, in downtown Jerusalem, a Palestinian construction worker driving a bulldozer attacked a woman and infant in a car, ramming the plow of his bulldozer into the woman’s windshield, decapitating the female driver with his plow. He subsequently used his bulldozer to lift two public transit buses loaded with civilian passengers onto their sides, trapping the passengers inside (see Fig. 1), and went on to crush several more cars. Several civilians were killed, and their mutilated bodies had to be extricated from cars crushed by the bulldozer. In addition to the fatalities, several people were injured in the attack. A number of survivors of that attack subsequently developed PTSD. The patient in the present case study was a passenger on one of the buses turned over in the attack. He was in grave personal danger and helped other passengers off the bus before escaping himself.

This case report presents the first results of a treatment based on Foa’s PE protocol but using VR to augment the imaginal exposure components during treatment of PTSD in a civilian survivor of the 2008 bulldozer attack.

Method

Participant

At pretreatment assessment, the patient was a 29-year-old middle-class married male Israeli citizen. He had recently survived the July 2008 terrorist bulldozer attack in Jerusalem and entered treatment approximately 1 month after the attack. He is college educated, has been employed full time since the traumatic event, and has had no prior treatment for PTSD. His “reexperiencing” symptoms included nightmares and intrusive images of the terror attack as well as nightmares and intrusive thoughts of previous traumas. His flashbacks of the bulldozer attack were very vivid, including smell. He showed significant physiological reactivity (fight-or-flight response) with these intrusions. His avoidances included trying not to think or talk about the event, avoiding traveling on buses, avoiding the place of the attack, and avoiding people of Arab descent. He reported significant sleep disturbance, anger outbursts, difficulty concentrating, and an exaggerated startle response. Pretreatment, the patient fulfilled criteria for PTSD related to the terrorist attack as well as a major depressive disorder. According to the pretreatment assessment, carried out with the Structured Clinical Interview for DSM-IV (SCID) and Clinician-Administered PTSD Scale (CAPS), the patient’s PTSD symptoms and depression had begun subsequent to the attack and included suicidal ideation, although with no concrete plans to commit suicide.
Although the patient showed no psychiatric diagnoses prior to the traumatic event, he did have pretrauma subclinical obsessive compulsive disorder (OCD), which had considerably worsened since the attack and now fulfilled criteria for OCD at pretreatment assessment.

**Apparatus**

During the VR exposure sessions, the participant wore a head-mounted display that included separate display screens for each eye and stereo earphones. The participant was presented with a computer-generated view of Virtual Israel BusWorld environment.\(^\text{12}\) He was able to look around the virtual world using a mouse. Our simulation of a terrorist bus bombing attack allows graded exposure wherein a therapist is able to control the severity of the scenario by pressing two function keys and by simply asking the participant to visualize various subsets of the attack while in VR. In the present study, the virtual environment depicted two increasingly distressing levels of exposure. Level 1 shows the street scene from an urban Israeli sidewalk, near a café, across the street from a bus stop. At level 2, a bus appears, approaches, and stops at the bus stop. Higher levels of BusWorld (levels 3 through 12), depicting suicide bus bombings of gradually increasing levels of severity (see Josman et al.\(^\text{12}\) for details) were available to the therapist but not needed with the present patient.

BusWorld was designed by our team with input from www.firsthand.com. Firsthand.com created the BusWorld VR software for our team, incorporating sound effects generously provided by Navy Commander Russell Shilling. BusWorld was originally designed to treat PTSD patients who had witnessed a terrorist suicide bus bomb explosion.\(^\text{12}\)

**Procedure**

All treatments and assessments occurred in the Department of Psychiatry, Hadassah University Hospital, Jerusalem,
Israel, with Institutional Review Board approval. At Hadassah Hospital, all patients who seek medical treatment at the emergency room following a large-scale terrorist attack are followed up afterwards by a psychologist. This patient received a telephone interview 4 days after the attack. During the interview, he described high levels of PTSD and depressive symptoms. He was invited to attend a clinical assessment, which took place 1 month posttrauma. At this assessment, standardized clinical interviews were carried out. The patient was asked to join the study, he signed informed consent, and began treatment 6 weeks after the terrorist attack. The clinical assessments carried out pre- and posttreatment were conducted by an independent assessor, a trained therapist who was blind to what treatment the patient received (i.e., was not aware that the patient’s treatment involved VR). The patient was assessed using two standardized clinical interviews: the Clinician-Administered PTSD Scale (CAPS) and the Structured Clinical Interview for DSM-IV (SCID-I). The interviews and questionnaires were repeated at the end of treatment. In addition, the patient completed several self-report questionnaires. The Beck Depression Inventory (BDI), Posttraumatic Symptoms Scale (PSI), Posttraumatic Cognitions Inventory (PTCI), and Brief Symptom Inventory (BSI) were filled out biweekly during the treatment.

Treatment

Because three of the imaginal exposure sessions took place while the participant was in VR, the treatment was not PE, which has a very strict definition. The treatment is based on PE, and treatment was carried out and supervised by therapists who have extensive knowledge and training in PE. The treatment was delivered during 10 individual sessions of 90 minutes each conducted approximately once weekly over a 12-week period. The initial session consisted of psychological education regarding PTSD symptoms as well as information regarding the VR system. The participant was taught a breathing exercise and asked to practice it as homework. During session 1, it became apparent that the trauma of the terrorist attack had resulted in reactivation of memories of previous traumatic events. As a result, the patient’s intrusive memories and images were a mixture of all these events. According to Foa’s manualized PE protocol, for patients with multiple trauma memories, the most distressing trauma memory should be treated first. For this patient, the most distressing memories were of childhood physical abuse he had experienced from his father. So the therapist treated the patient’s issues with childhood physical abuse first.

In the second session, a hierarchy for in vivo exposure was established, the rationale for in vivo exposures was explained, and the client and therapist together chose an exposure task that the client carried out for homework. In sessions 3, 4, and 5, the client carried out imaginal exposure while in virtual reality (i.e., imaginal + VR exposure). The rationale for imaginal exposure in VR was first explained to the patient, and he put on the VR helmet. While in VR, the patient was asked to tell the story of the event in first person, present tense. The therapist was able to see what the client was viewing in VR and was able to control the level of exposure. As therapy progressed, the sessions of VR with imaginal exposure addressed “hot spots” where the patient focused on particularly difficult parts of his memory of the traumatic event(s). For example, in session 3, he carried out the imaginal exposure regarding his childhood physical abuse while in VR BusWorld. The first level of VR BusWorld was used. His eyes were open, and he was viewing BusWorld as he repeated described his childhood physical abuse to his therapist using imaginal exposure. He was fully engaged throughout, initially reporting high ratings on the Subjective Units of Distress Scale (SUDS). SUDS ratings gradually declined in a pattern indicating habituation. At the end of the session, the patient reported relief and explained it was the first time he had ever told the story of the abuse. For homework, he carried out further in vivo assignments and listened to the associated audio recording of his therapy session. At session 4, the client reported that the previous session had helped. He was now no longer having intrusive memories of his childhood physical abuse. Imaginal exposure during VR was now used to help him process his emotions associated with his pathological memories of the terrorist bulldozer attack. He was reluctant to begin, and his anxiety was very
high (SUDS = 85). Once he did start, the anxiety went down suddenly (SUDS = 50); the therapist felt he was disengaged and so increased BusWorld to level 2. This increased engagement and anxiety, and the SUDS rose to 70 and then gradually fell back to 50 in a pattern more typical of habituation. Homework involved in vivo exposure by looking at a real bulldozer from a distance of 50 meters also included listening to the audio recording of his most recent imaginal exposure session (including what he told the therapist during the therapy session and what the therapist said). He was reporting high levels of anger and expressed concern that he would act on his anger. As a result, session 5 included CBT for anger management. In session 6, the client reported that listening to the audio recording of his therapy sessions (which had previously made him anxious before he habituated) no longer resulted in any anxiety at all. At this point in his recovery, most of his current anxiety was related to the increase in OCD symptoms precipitated by the bulldozer terrorist attack. Since he had been experiencing some intrusive memories from a third traumatic incident, from his time as a soldier in the army, this was treated with imaginal exposure (without VR). In session 7, no imaginal exposure was carried out, since he reported no more intrusive memories or anxiety. Instead, exposure was carried out by showing the patient photographs of bus accidents, terror attacks, and terror attack victims. Extinction took place very quickly to these images. Over the next three sessions, he continued exposures to bulldozer-related images, including videos. During homework between sessions, he carried out real-life in vivo exposures to bulldozers, including standing close to a working bulldozer.

After the final VR with imaginal exposure session, the therapist summarized all the progress the patient had made during the course of treatment and reviewed techniques he could use after therapy was completed, (e.g., being less avoidant of his memories of traumatic events, reducing avoidant behaviors in the real world, increasing naturally encountered in vivo exposures). These techniques help patients maintain the progress they have made and, ideally, to continue to reduce their PTSD symptoms over time post-treatment.

### Results

The client’s SUDS ratings indicated both within-session and across-session habituation to anxiety at each level of exposure. He showed no psychiatric diagnoses prior to the traumatic event. After the attack, pretreatment, the patient fulfilled criteria for PTSD related to the terrorist attack as well as a major depressive disorder. According to the pretreatment assessment, carried out with the SCID and CAPS, the patient’s PTSD symptoms and depression had begun subsequent to the attack and included suicidal ideation, although with no concrete plans to commit suicide. Although the patient showed no psychiatric diagnoses prior to the traumatic event, he did have subclinical OCD prior to the trauma, which had considerably worsened since the attack and now fulfilled criteria for OCD at pretreatment assessment.

At the posttreatment assessment after his last session and at 6-month follow-up, the SCID, CAPS, and BDI showed that the client had fully recovered from PTSD, depression, and OCD. The self-report questionnaires also showed a significant reduction in symptom levels (see Tables 1A and 1B). Regarding the value of his in vivo exposures, during the completion of the CAPS at posttest, the patient said, “Every day I pass by the place of the attack at least twice. I think of what happened and continue on my way. This week, for the first time since the attack, I went on the same bus I took when the attack happened. I sat on the ‘unsafe’ side and said to myself ‘I’m doing this and everything is all right.’” At 6-month follow-up, the client reported that the therapy had helped him in many areas of his life. He has returned to full functioning and passes the site of the attack almost daily.

### Discussion

In this case study, a PE-based program involving imaginal exposure augmented by VR was effective for the treatment of PTSD. There was a large pretreatment to posttreatment reduction of symptoms as evaluated by the CAPS, posttraumatic stress symptoms, and Posttraumatic Cognitions Inventory (PTCI; avoidance, reexperiencing, arousal, and cognitions). These gains held at 6-month follow-up. There was also a reduction in general psychopathology as measured by the BSI and BDI. Although the level of depression

### Table 1A. Pretreatment to Posttreatment Assessment Scores

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>6 months posttreatment follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPS Total</td>
<td>79</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAPS</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reexperiencing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPS Avoidance</td>
<td>21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAPS Hyperarousal</td>
<td>33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BDI</td>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BSI</td>
<td>100</td>
<td>4</td>
<td>15</td>
</tr>
</tbody>
</table>

### Table 1B. Scores in Self-Report, Questionnaires at Pretreatment and Posttreatment, at Sessions 2, 5, 10, and 12, and at 6 Months Posttreatment Follow-Up

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pretreatment</th>
<th>Session 2</th>
<th>Session 5</th>
<th>Session 10</th>
<th>Session 12</th>
<th>Posttreatment</th>
<th>6 months posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PSS</td>
<td>31</td>
<td>30</td>
<td>11</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTCI</td>
<td>88</td>
<td>104</td>
<td>52</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The patient showed remission of PTSD symptoms after completing therapy. BDI, Beck Depression Inventory; PSS, posttraumatic stress symptoms; PTCI, Posttraumatic Cognition Inventory; BSI, Brief Symptom Inventory.
at pretest measured by the BDI was not clinically significant, the SCID revealed a pretreatment diagnosis of major depression disorder. At the end of the treatment, as well as at 6-month follow-up assessment, the client no longer met criteria for this disorder nor for another disorder identified at pretest, OCD. Although case studies are inconclusive by nature, the strong impression of the therapists was that VR accelerated the effect of imaginal exposure, reducing the need to repeat sessions. In this case, two difficult traumatic events (childhood physical abuse and the bulldozer attack) needed an unusually small number of imaginal exposure sessions while in VR to result in a large decrease in the number of intrusive thoughts and images and a large reduction in the impact of PTSD symptoms on the patient.

Other VR therapy worlds for treating PTSD have made use of imaginal exposure while the patient was in a virtual world: WTC World,6,9 IraqWorld,20 Virtual Vietnam,7 and Virtual Iraq.21 For example, in the real September 11 attacks on the World Trade Center, thousands of pedestrians were on the streets of Lower Manhattan during a Monday morning rush hour. Yet in a VR exposure therapy software depiction of the attacks, there were no pedestrians, and no police cars, fire trucks, or ambulances were visible in the virtual world. WTC World left it up to users to fill in missing information with their own individual recollection/self-generated imagery. In short, VR was used to provide a context, and imaginal exposure was used by the patients while they were in VR. However, WTC World shows simulations of the terrorist attack in a sequence of increasingly realistic depictions. Level 1 shows a blue sky before the attack, and no planes are visible. At level 2, a plane flies by but does not attack. At level 3, a plane hits WTC building but does not explode, and no sound effects are heard. At level 4, a plane hits WTC building with an animated explosion but no sound effects. At level 5, a plane hits WTC building with animated explosion and corresponding sound effects; the audio and visual effects become progressively severe up to level 12.

Unlike the abovementioned clinical VR therapy worlds for PTSD, in the present use, BusWorld did not show any terrorist attack. No suicide bomber blew up the virtual bus, no bulldozers were visible in VR, no cars were crushed, no bus was lifted over onto its side, no sounds of metal bending were heard, no blood or broken glass was visible, no gasoline leaked onto the sidewalk, no people (avatars) were visible, and nobody screamed in BusWorld as used by this client. These details were all left up to the client to self-generate from memory, using imaginal exposure based on his own idiosyncratic experience/eyewitness perspective of what happened during the terrorist bulldozer attack. The approach used in the current study was a hybrid between previous uses of VR exposure (involving simulations of the terrorist attacks) and previous uses of conventional imaginal exposure with no VR.

VR with imaginal exposure combines the increased emotional engagement of VR with the high flexibility of imaginal exposure. For example, to our knowledge, the present study is the first attempt to use imaginal exposure with VR for a traumatic event that is, to a casual observer, completely unrelated to the content of the virtual world. The patient had the illusion of being in BusWorld as he repeatedly described his childhood physical abuse to his therapist using imaginal exposure. BusWorld triggered not only his memories of the bulldozer attack but also his memories of childhood abuse, which were associated with the his more recent memories for the terrorist bulldozer attack on his bus. In this client’s case, being in BusWorld helped him access his memories of his childhood abuse. The memories of the bus attack and the memories of childhood abuse may have been in the same “fear structure” in memory (a mental program for escaping danger). We speculate that one reason patients with multiple traumas are so avoidant of the most recent trauma is because the recent trauma memory is a doorway to other painful memories from previous traumas.

In the current study, VR was used by the therapist to help keep the client emotionally engaged during therapy. For example, in one instance when the therapist felt the patient had disengaged, the therapist increased the level of VR (i.e., had a public bus pull up to the Israeli bus stop), leading to an increase in the patient’s emotional engagement. Most people who experience a traumatic event show high PTSD symptoms initially but show spontaneous symptom reduction with no therapy and do not end up with chronic PTSD. In one of the few studies on the topic, Rothbaum et al.22 showed that starting 4 weeks after the traumatic event, PTSD patients showed little or no spontaneous improvement without therapy. Thus, it is unlikely that the patient’s progress in the current case study is due to spontaneous improvement.

Other patients from the same bulldozer terrorist attack in Jerusalem who developed PTSD were treated by the same therapist as in the present study, using PE without VR. Those receiving PE with no VR also showed a significant reduction in symptoms. However, with conventional PE, the imaginal exposure took longer, with at least six imaginal exposure sessions. Whether VR improves outcomes or increases the speed at which exposure takes effect, or whether patients progress just as far and quickly with Foa’s PE with no VR, are important topics for future research using randomized controlled trials. The contribution (if any) of VR to outcome is an important research topic.

Difede et al.8 included five patients who had failed to respond to PE with no VR. All five of these patients subsequently showed at least 25% to 50% or more reductions in PTSD symptoms after completing CBT with imaginal exposure augmented by immersive VR. Future research is needed on whether refractory patients who fail to respond to conventional therapy can still benefit from VR exposure therapy.

This report involves a case study, and the substantial limitations of this methodology are well known.23 Although case studies are a good vehicle for presenting innovative techniques, evidence for effectiveness requires converging results from larger, more generalizable, carefully controlled studies.

Although CBT involving exposure is the most empirically supported intervention for PTSD,4 most people who have PTSD never seek treatment, and most people with PTSD who seek treatment never receive CBT involving exposure (e.g., PE). Although large-scale efforts to increase dissemination are under way, CBT with exposure is not widely used by clinicians in the community who treat patients with PTSD.5 VR has potential to increase the proportion of patient with PTSD willing to seek treatment. Researchers speculate that VR (especially VR with D-cycloserine fear extinction learning enhancer20) may reduce the number of therapy sessions patients need to complete treatment. Surveys show that people with
PTSD and other anxiety disorders report being unusually receptive to seeking therapy that involves VR.24,25

The present results showed for the first time that a modified PE protocol using VR to facilitate the imaginal exposure was effective for treating PTSD stemming from a terrorist attack in Israel. VR helped the patient remember and habituate to his memory of the traumatic event and helped him stop avoiding his memory. Although preliminary, these results suggest that this topic is worthy of further research.

Disclosure Statement

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References


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