PTSD Elderly War Veterans:
A Clinical Controlled Pilot Study

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Abstract

Around 25,000 war veterans in Portugal suffer posttraumatic stress disorder (PTSD). This clinically controlled study evaluates virtual reality exposure therapy (VRET) as an alternative procedure to reduce PTSD symptoms. Ten patients were assigned to three groups: VRET, exposure in imagination (EI), and waiting list (WL). The patients were Portuguese veterans from a series of wars fought in former African colonies more than 30 years ago. While the EI group participated in traditional imagination therapy, the VRET group was exposed to a virtual reality (VR) war scenario. Cues such as ambush, mortar blasting, and waiting for rescue were used in the VR. Patients enrolled in the VRET group showed statistical reduction of PTSD-associated disorders like depression and anxiety. Far from being conclusive, this pilot study nonetheless presents some promising data on the use of VRET on old war veteran populations.

Introduction

The incidence of anxiety disorders in psychiatric populations is 18.1%, with a lifetime prevalence of 28.8% being the most common type of psychiatric disorder.1 Despite not being the most prevalent anxiety disorder, posttraumatic stress disorder (PTSD) is found in 5.2 million U.S. adults ranging in age from 18 to 54 in any given year.2 A large spectrum of traumatic events can lead to PTSD. Warfare is one of the severest due to the physical, emotional, cognitive, and psychological high demands of the combat environment.3 A recent study of soldiers from the Iraq conflict revealed that 15.6% to 17.1% meet the criteria for major depression, generalized anxiety, or PTSD.4 A similar study was conducted in the Portuguese adult population, revealing a PTSD prevalence of 7.87%. Concerning war PTSD, around 10% of war veterans developed this disorder.5

The cognitive-behavior therapy (CBT), a time-limited, present-oriented approach to psychotherapy, improves patients’ cognitive and behavioral competencies needed to function adaptively.6 The exposure in imagination and the in vivo exposure are the most common therapeutic techniques.7 Nevertheless, they both have some shortcomings where PTSD treatment is concerned. This might happen because there is substantial difficulty inducing an anxious mental scenario in some PTSD patients.8

The increasing accessibility to powerful personal computers and 3D visualization techniques has made possible the development of virtual reality (VR) and its use on mental health. This technological technique (tech-tech) is being used to treat patients with several anxiety disorders.9 Virtual reality exposure therapy (VRET) might be a better technique due to its realistic approximation of the real world.10 VRET induces higher levels of immersion than does imagination exposure.11–13 Hyperrealistic threatening stimuli provided by VRET leads to higher attention10 and subsequent encapsulation, indicating that once the fear system is activated, it is difficult to control its response by verbal instructions or stimulus consciousness.14 According to Vincelli,10 VRET then reduces the decalage between reality and imagination by diminishing potential distraction or cognitive avoidance of the threatening stimuli. These and other studies9,15–19 revealed that VRET can be an alternative to in vivo and imagination exposure. VRET enables patients to be immersed in the VR world, creating the sense of being there. This sense, also called presence, provides the ability to interact with the VR world as if one were truly in the real environment.20

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infinitum without the patient leaving the therapist’s room. Particularly for patients with PTSD, it is possible to reproduce cues of events that are not replicable in real-life situations. The therapeutic VRET potential and its advantages in war PTSD treatment have been shown in several studies. Between 1961 and 1974, Portugal was engaged in three wars in its former colonies of Angola, Mozambique, and Guinea-Bissau. During this period, around 1 million soldiers were drafted to fight in a guerrilla-type war. Many of them developed PTSD after returning home. Today, it is estimated that around 25,000 war veterans still meet the DSM-IV criteria for PTSD.

The purpose of the present study is to investigate whether VRET brings about a decrease of depression, anxiety, and PTSD symptoms in elderly war veterans when compared to veterans exposed to imagination and those enrolled on a waiting list.

Method
Participants
The study sample consisted of 10 male war veteran patients (M = 63.5 years; SD = 4.43) with war PTSD. Each patient was diagnosed by his assistant psychiatrist through a clinician-administered PTSD scale (CAPS) structured interview from DSM-IV. These patients participated in the Portuguese colonial war between 1963 and 1970 in Africa.

The participants were randomly assigned to three study groups: five to the VRET group, two to the exposure in imagination (EI) group, and three to the waiting list (WL) group. The VRET group suffered one drop-out.

Each patient’s assistant psychiatrist agreed to maintain stable medication regimens in order for the patient to participate in this study. Prior to enrollment, patients gave their informed consent. Exclusion criteria consisted of cardiovascular disease, epilepsy, and absence of informed consent from the assistant psychiatrist.

Materials/apparatus
Regarding the self-report measures, PTSD symptoms avoidance, intrusion, and hyperarousal were evaluated by the Impact of Events Scale Revised (IES-R). Psychopathology and depressive symptoms were respectively assessed by the Symptoms Checklist Revised (SCL-90-R) and the Beck Depression Inventory (BDI). The VRET group was also assessed with self-report measures in order to control VR-related variables like the sense of presence, immersion, and cybersickness (ITC SOPI).

Patients were exposed through a Z800 head-mounted display (e-Magin Corp.) plugged to a high-end computer with dual core processor (4 GB RAM) and a 3D graphics unit with DirectX 10 support (Nvidia 9600 GT). The hardware was installed in the Association for War Veterans in Lisbon, Portugal.

Procedure
The study design consisted of a controlled study (i.e., VRET, EI, and WL groups). Both the VRET and EI conditions maintained the regular psychotherapy rationale based on cognitive desensitization with 12 graded exposure sessions of VR for the VRET condition and 12 sessions of imagination exposure for the EI condition. Patients in the WL condition (control group) were enrolled in the VRET group after the final assessment. These results will be discussed at a later date in a following study.

The PTSD clinical diagnosis was established in the first session along with the self-report measures for PTSD symptoms (IES-R) and psychopathology (SCL-90-R). The last assessment was conducted with the CAPS, IES-R, and SCL-90-R. Data for depression (BDI) was also collected for the VRET condition.

In the VRET group, exposure began in the second treatment session; self-report data for the sense of presence was also collected at the end of the session. For both experimental groups, VRET and EI, the first session was dedicated to patients’ anamnesis and psychoeducation for anxiety management techniques. In order to better understand VRET, the patients in the experimental condition were also assessed during treatment (at the end of the fifth session) with self-report measures (IES and SCL-90-R). Being an elderly and chronic sample, one of the challenges of the study was to reduce the chances of dropping out. In this way, the assessment’s events and instruments were reduced to a minimum in order not to overload the patients and break the therapeutic flow.

The displayed VR world was developed using Hammer graphics editor (Valve Corp.) and consisted of a footpath surrounded by dense vegetation, where the participants had to follow a column of virtual soldiers (Fig. 1).

As seen in Figure 2, the activating episodes were composed of three typified cues. Each cue is described as follows: ambush (A), sounds of gun firing (AK 47) and tracing bullets; mortar (M), sound of blasting amidst black smoke and spraying particles; waiting for an evacuation (E), waiting near an injured soldier for an Alouette II to fly in and evacuate him. According to this hierarchy, Figure 2 shows the increasing intensity and frequency from session to session.

FIG. 1. Activating cues in the virtual reality exposure therapy.
Results

To evaluate the effect of the experimental group on the dependent variables for PTSD assessment and psychopathology, statistical analyses were carried out through a repeated measures ANOVA with one within-participant factor with two levels (pretreatment and posttreatment) and one between-participants factor with three levels (VRET, EI, and WL groups).

For the CAPS screening scores, the ANOVA showed no statistically significant effects ($\pi > 0.05$). However, through the descriptive analyses, an 8% decrease was observed on PTSD symptoms for the posttreatment condition in VRET group as well as for EI (1%) and WL groups (6%). Criterions B, C, and D are described in Table 1.

The same design was performed for the self-report measures of PTSD. Descriptive analysis showed a reduction of the IES-R scores only for the VRET condition, whereas for the WL and EI, an increase was reported (Table 1).

Regarding the psychopathology dimensions, a reduction of SCL-90-R mean scores for the VRET group was observed. Inferential analysis (ANOVA) showed an effect of statistical interaction between factors for depression, $F(1, 5) = 12.490; p = 0.011$. This indicates a significant decrease in depressive symptoms (Fig. 3) from the pretreatment to posttreatment assessment for the VRET group.

Descriptive analysis for the sense of presence (ITC-SOPI) indicated that 65% of the patients agreed, or strongly agreed, that they were present in the VR world, and 62% reported no negative effects after exposure.

The BDI for depression was assessed only for the VRET group. Repeated measures ANOVA with one within-participants factor with two levels (pretreatment and posttreatment) revealed significant differences between assessments for depression total score in the VRET condition, $F(1, 3) = 75.000; p = 0.003$, reflecting a significant decrease from pretreatment to posttreatment assessment. As seen in Figure 4, the BDI total scores decreased about 40% from moderate depression ($M = 24.25; SD = 9.46$) to mild depression state ($M = 14.25; SD = 7.67$).

Within group analysis, VRET group was evaluated with SCL-90-R and the IES-R in three assessments: pretreatment, during treatment (after the fifth session) and posttreatment (after the 12th session). SCL-90-R scores were analyzed through a repeated measures ANOVA with one within-participants factor with three levels (pretreatment, during treatment, and posttreatment). The results showed statistically significant differences between assessments for the following SCL-90R dimensions: somatization, $F(2, 4) = 24.589; p < 0.01$, and anxiety, $F(2, 4) = 9.224; p < 0.05$, with a significant decrease on psychopathology scores on the posttreatment assessment (Fig. 5). Estimated marginal means were compared through post hoc tests with Bonferroni adjustment.

Table 1. Percentage Variation between Pretreatment and Posttreatment Assessments for VRET, EI, and WL Groups

<table>
<thead>
<tr>
<th></th>
<th>VRET (%)</th>
<th>EI (%)</th>
<th>WL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPS total severity</td>
<td>–9</td>
<td>–1</td>
<td>–6</td>
</tr>
<tr>
<td>Intrusion (criterion B)</td>
<td>–18</td>
<td>–1</td>
<td>–20</td>
</tr>
<tr>
<td>Avoidance (criterion C)</td>
<td>–38</td>
<td>4</td>
<td>–13</td>
</tr>
<tr>
<td>Hyperarousal (criterion D)</td>
<td>10</td>
<td>–10</td>
<td>20</td>
</tr>
<tr>
<td>IES: avoidance</td>
<td>9</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>IES: intrusion</td>
<td>–7</td>
<td>–5</td>
<td>–2</td>
</tr>
<tr>
<td>IES: hyperarousal</td>
<td>–4</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>IES-R score</td>
<td>–1</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
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EI, exposure in imagination; VRET, virtual reality exposure therapy; WL, waiting list.

Discussion

This study focused on a controlled trial that compared war veterans with PTSD symptoms using three conditions: VRET, EI, and WL. VRET participants were exposed to a VR world, where anxiety-propelling cues were displayed (ambush,
FIG. 3. Effects of the experimental group on the SCL-90-R depression subscale for virtual reality exposure therapy, exposure in imagination, and waiting list groups.

FIG. 4. Beck depression analysis between pretreatment and posttreatment assessments for virtual reality exposure therapy.

FIG. 5. Somatization and anxiety analysis between treatment assessments (pretreatment, during treatment, and post-treatment) for virtual reality exposure therapy.
mortal/mine blasting, and waiting near an injured soldier for helicopter rescue).

VRET seemed to deliver at least the same results as EI. The results obtained after the last assessment (12th session) showed a decrease in PTSD (CAPS) as well as on psychopathological (SCL-90-R) symptoms in the VRET group when compared to EI and WL groups. This decrease was significant only for depression scores. Despite not having many controlled studies available, the same trend was found.

VRET appears to have also caused a reduction in patients’ depression and anxiety levels. After the 12 therapy sessions, the veterans who were exposed to VR cues reported less anxious behavior and reduced depressive symptomatology.

Despite the difficulty of generalization due to a small sample size, these results are encouraging. They suggest that elderly war veterans with chronic PTSD can benefit from VRET. However, a follow-up assessment should done 6 months after the last session in order to corroborate these findings and account for the nature of PTSD.

In a further study, an enlargement of the sample size would be required to evaluate the reproducibility of this gain.

Also, psychophysiological and neuropsychophysiological assessments and monitoring should be considered. The first can provide a better insight of the fear response associated with the anxiety cues during VRET. The second can help in better understanding the anatomic and functional mechanisms of PTSD. Functional neuroimaging suggests that PTSD patients differ cognitively and behaviorally while re-experiencing traumatic events. The authors suggest that different neuronal mechanisms may generate these different reactions of traumatic triggers. Regardless of the findings, the pathophysiologic nature underlying PTSD is not yet clear. Moreover, the effects of psychotherapeutic treatment protocols on the structure, and consequently on the functions of related brain systems, are not yet known.

Another limitation concerns the number of evaluations made for the EI and WL groups, as stated in the method section. This design did not allow for group comparisons among the three assessments. Yet these preliminary results suggest that VR can be an option for the psychotherapeutic process. As demonstrated by other studies, it is possible through VRET to force patients to relive and to be emotionally engaged in a traumatic war event—one of the central goals of psychotherapy.

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Disclosure Statement

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References


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