

# Post-traumatic stress disorder treatment with virtual reality exposure for criminal violence: a case study in assault with violence

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## ABSTRACT

The criminal violence is attached with mental health problems as depression and substance use and abuse. However one of most important psychological problems linked with the victims of violence is post traumatic stress disorder (PTSD). In Mexico, according to the ENSI-5 in 2009, 11% (6,800/for each 100 thousands of habitants) of the population over 18 years, experienced a crime. One in four of the people victim of violence develops PTSD symptoms. Due to this socially relevant problem and based on the efficacy treatments, it is important to design treatments involving the use of Virtual Reality (VR), because it can help overcome some of the limitations of traditional therapy using exposure. The present paper expounds a case study of treatment program to PTSD in assault with violence.

## 1. INTRODUCTION

Violence is an issue of great importance for the general population, because of their health and economic implications. Assaults in the public streets create an atmosphere of danger and vulnerability. According to the World Health Organization (WHO, 2002), violence has important implications; both psychologically and physically, among the consequences of violence are depression, alcohol use and substance abuse. The most important psychological difficulties experienced by victims, are post-traumatic stress disorder (PTSD).

In Mexico, according to data reported by the National Survey on Insecurity (ICESI, 2009) reported that 11% (6,800 / per 100 thousand inhabitants) of the population over 18 years old was victim of a crime. Over these cases, 1 in 4 had PTSD symptoms. The National epidemiologic psychiatric survey (Medina- mora, Borgues, Lara, Ramos, Zambrano & Fleiz, 2005), informed that 5.6% of urban population presents PTSD after suffering kidnapping and 1.8% for robberies or assaults with weapons. Contemplating this background, it is important to note the great impact of violence on mental health. It is remarkable that PTSD requires attention because who suffers from this disorder has elevated degrees of anxiety, fear and avoidance, could be presented in different ways that interferes in the personal development and everyday life of persons.

People who experience an assault start to show psychological and physiological responses as a result of the threat to their personal integrity. They suffer the risk of losing their life or physical injuries. Posttraumatic adaptation is the result of the interaction of multiple variables (Williams & Yule, 1997). Some of these variables are the appreciation and appraisal of the incident, the characteristics and consequences of the aggression and the coping skills of each individual (Carvajal, 2002; Harvey, 1999). Medical assistance, hospitalization, invasive treatments and rehabilitation produces variations in the emotional response on the individual (Michaels, Smith, Moon, Peterson & Long, 1999).

A psychological consequence after being in a threatening incident not only depends in the intensity and characteristics of the situation but also in the differences between individuals; such as: age, background violent experiences, emotional stability, psychological resources, self-esteem, social and familiar support among others. For this reason risk and protector factor are important issues in order to understand the psychological consequences of traumatic events (Echerburúa, Amor & Corral, 2005).

The Posttraumatic stress disorder (DSM-IV-TR, 2000) appears when the person experience or witness a physiological injure or incident that threaten their life or the life of other person. Enclosed with the situation

they feel an intense fear, horror and defenseless. There are three important aspects for the clinic diagnostic of PTSD: a) intrusive thoughts and constant involuntary flashbacks of the traumatic event; b) cognitive and behavior avoidance of places and situations related with traumatic incident; and c) hyper activation responses such as concentration problems, irritability and sleeping disturbance (Rothbaum y Foa, 1996). Nowadays there are effective cognitive-behavior (CBT) treatments for PTSD. These treatments employ exposure techniques that help patients to overcome the presence of feared objects or situations related with the traumatic event. Prolonged exposure (PE) is the exposure technique preferred for treating PTSD (Foa, Friedman & Keane, 2000). However this technique is poorly used in clinic treatments (Becker, Zayfert & Anderson, 2004). The lowest used of these treatments is due to cognitive avoidance of patients to recall traumatic memories and the difficulty for some patients to imagined (Botella et al, 2006).

Virtual reality exposure technique (VR) can help to overcome some restrictions of traditional exposure therapy (in vivo or imagined). VR can simulate the traumatic situation with a high sense of reality; therefore this can help patients no matter its ability for imagined. Other benefit is that therapists can control the characteristics of the situation presented to the patient. These aspects could reduce cognitive avoidance in order to increase the emotional implication during exposure. This innovating treatment implies high benefits; easy procedures and recent studies reported effectiveness in treating anxiety disorders, eating disorders, addictions, pain management, palliative care and rehabilitation (Rizzo, 2006).

## 2. METHOD

### 2.1 Objective

Determinate the effects of virtual reality exposure in PTSD treatment program for criminal violence victims.

### 2.2 Participant

The participant is a 22 years old, young man, who covered the DSM-IV criteria for posttraumatic stress disorder, types I, for assault with violence and accepted under informed consent to participate in research. He reported had suffered five months ago an assault with violence and death threats by an intoxicated man. As a result, the patient experiences anxiety levels to talk to unfamiliar people or strangers. The participant, reliving the event in the form of repeated and uncontrollable memories through nightmares, which presents anguish, as well as psychological distress, fear to repeat the incident and also by the presence of avoidance behavior, such as not going out alone at night, not pass on alone sites, in addition, to avoid violence programs or discussions concerning the traumatic memory. He showed symptoms of anxiety (physiological arousal), sweating, rapid heart rate and trembling at the memory of the traumatic event or related situations.

### 2.3 Procedure

A preliminary screening and interview was conducted during which the participant was informed about study details at Psychology Health Center at UNAM. A PTSD diagnosis was determinate by clinician Administrated PTSD Scale (CAPS-1; Blake et al., 1990; Palacios, 2002), PTSD check list, The PTSD symptom Scale Self Report (PSS; Foa, Riggs, Dancu & Rothbaum, 1987; Almanza et al., 1996), The Beck Depression Inventory (BDI, Beck, et al., 1961; Jurado et al., 1998), The State-Trait Anxiety inventory (STAI, Spielberger, 1983; Spielberger & Díaz-Guerrero, 1975) and Quality of Life Inventory (INCAVISA, Sanchez-Sosa, et al., 2009).

### 2.4 Treatment

Treatment was delivered in 10, 90- minute individual sessions conducted once weekly (Rothbaum, Difede & Rizzo, 2008). In session 1, the participant received information about the treatment rationale, education around common reactions about trauma, and breathing relaxation training. Session 2, was focused in traumatic memory. This was explained in the education context about exposure therapy as a medium to confront feared memories and processing the memory. Session 3, consisted to construct a hierarchy of situations or activities and places the participant was avoided, in order to assigning specific in vivo exposures for homework. Session 4- 9 consisted of repetition of the traumatic memory with VR exposure. Subjective Units of Distress (SUDS) ratings ranging from 0 to 10 were asked to the patient every 5 minutes during the exposure. Session 10, was a final session, includes discussion about the continued practice of all that the patient was learned in treatment.



**Figure 1.** *The VR-system provides confidence to the patient to learn that the virtual environment is handled by the therapist through a keyboard or electronic panel that ensures total control of exposure in real time.*

## 2.5 Materials

- PC Pentium III (1000KHZ, 256 MB , CD-ROM drive y graphic board AGP, 64 MB, by Open GL.
- Head mounted display (HDM)
- Mouse, board, earphones, loudspeakers
- Microsoft Windows Software (95, 98, ME, 2000 o NT 4.0.)

## 2.6 PTSD Scenario Settings

Was used 2 virtual developments for PTSD, which are dynamic graphical environments and three-dimensional (3D), Studio Max, high acoustical and tactile, modeled through a computer-oriented simulation of situations or real world variables. The PTSD scenario settings (Cárdenas, 2009) were a streets of Mexico City scenario, which includes a pedestrian bridge, and a vehicle (taxi / wagon), with the aim of exposing the patient to the memories of the trauma. In order to achieve the immersion of the participant, each scenario is navigable and interactive. Note that virtual environments are designed, considering the social and cultural context appropriate for the target users of the system.

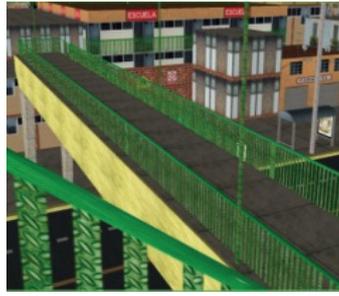
Streets of Mexico City scenario: As a public space, is considered a scenario feared by patients, perceived as an unsafe place, which puts them in a vulnerable situation of assault or kidnapping. Through this scenario, the user walks freely through the avenue. Maybe incorporated into virtual characters (avatars) look suspicious that approximates the user with different levels of closeness (Fig. 2).

Pedestrian bridge: The model begins in the early part of the stairs of a footbridge, the patient can walk across the bridge up the stairs and walk through the narrow corridors to reach the other side and cross the street, as well alone or with people who obstruct passing through the bridge in order to continue exposing and confronting the patient to feared places and catastrophic ideas about going out and doing daily activities (Fig. 3).

A vehicle (taxi / wagon): This scenario represents one of the most feared by people who have been victims of assault. The user is confronted with elements of discomfort or anxiety triggers, such as victimization by the driver and interception of other frightening characters, which together with other associated stimuli, such as streets closed path, lighting the stage, will allow you to recreate the feared situation (Fig. 4).



**Figure 2.** City view.



**Figure 3.** Bridge view.



**Figure 4.** Taxi view.

### 3. RESULTS

The participant's clinical levels of PTSD and Depression significantly reduced and his level of anxiety measurable reduced from his pre-treatment assessment to post-treatment assessment were showed in table 1. Specifically, at the end of 10 sessions of VR program treatment, The CAPS score decrease by 51 % from total score (81). The PTSD symptom Scale ratings decreased from 35 to 20. The participant was assessed at the end of the treatment, and not meeting the DSM-IV criteria for PTSD.

**Table 1.** Pretreatment to Post-treatment Assessment ratings

Measure	Pretreatment	Post -treatment
<b>CAPS total</b>	81	40
<b>CAPS Reexperiencing</b>	20	8
<b>CAPS Avoidance</b>	37	10
<b>CAPS Hyperarousal</b>	24	16
<b>PTSD symptom Scale</b>	35	20
<b>BDI</b>	16	5
<b>STAI</b>	47	25

**Table 3.** SUDS ratings (1-10): In Vivo Exposure Hierarchy

Task	SUDS Sessio3	SUDS session4	SUDS session5	SUDS session6	SUDS session7	SUDS session8	SUDS session9	SUDS session10
Taking public transportation	7	5	5	5	4	4	3	3
Talking to strangers	8	6	5	4	5	3	3	3
Watching movies that has some violence	6	7	6	4	4	4	3	3
Being watching or touching by someone	7	7	6	5	5	5	4	3

Table 3 showed significant changes to reduce levels of anxiety through in vivo exposure for homework during treatment program. Anxiety reduction was showed during sessions by decreased level of reexperiencing, avoidance and hyperarousal ratings. The SUDS rating progressively decrease within sessions (Table 2).

**Table 2.** Subjective Units of Distress (SUDS) rating (1 -10) during Virtual Reality Exposure sessions

Session Number	Beginning	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
4	8	6	7	8	7	5	4
6	9	7	7	8	6	4	4
8	7	6	7	6	6	5	4
10	5	4	3	4	4	4	4

#### 4. CONCLUSIONS

According with obtained results, the prolonged exposure treatment with virtual reality was effective in reducing symptoms of reexperiencing, avoidance and hyperarousal. The participant reported feeling comfortable with technology. In addition, He reported experiencing improvement in functioning in many areas of his life as a result of treatment.

The combination of new technologies for psychological treatment seems to be a promising alternative for the care of PTSD in victims of criminal violence, which have great impact on our country, supporting the spread of empirically validated treatments in the Mexican mental health field. However, PTSD treatment program with virtual reality in criminal violence is recommended to test with a larger sample and in a randomized controlled trial with another experimental condition to compare the results.

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