Virtual Reality Exposure vs. Prolonged Exposure for PTSD: Which Treatment for Whom?

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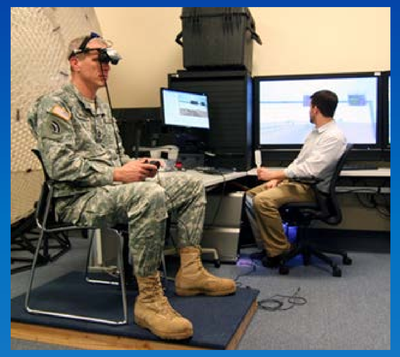
INTRODUCTION

- Prolonged exposure[1] (PE) is a gold-standard treatment for PTSD.
- Emotional engagement and activation of fear structures during exposure are considered to be important mechanisms of PE[2].
- Researchers have used virtual reality during exposure therapy (VRE) to facilitate increased fear activation[3], and VRE has demonstrated effectiveness in the treatment of PTSD[4].
- However, a recent RCT of VRE versus PE found no significant differences between PE and VRE for changes in PTSD symptoms at post-treatment, and that PE slightly outperformed VRE at a 3 and 6 month follow-up[5].
- Though results of this recent study did not support VRE as a superior treatment, an important unanswered question is whether specific individuals would do better in VRE as compared to PE.
- The current study sought to examine whether there are individual difference characteristics that predict a participant would achieve greater symptom reduction in VRE as compared to PE.

METHODS



Procedure

- Analyzed data from a previous randomized clinical trial[5].
- Participants randomized to VRE, PE, or a waitlist control (waitlist not included in analyses).
- Outcome: PTSD Sxs – CAPS weekly ratings measured at 3 time points.

Participants (N = 108)

- Active duty soldiers with PTSD from OEF/OIF deployments.
- Majority male (95.4%), Non-Hispanic White (63.9%), and married (73%). Ages ranged from 21 to 49 (M=30.20, SD=6.79).

Data Analysis[6,7]:

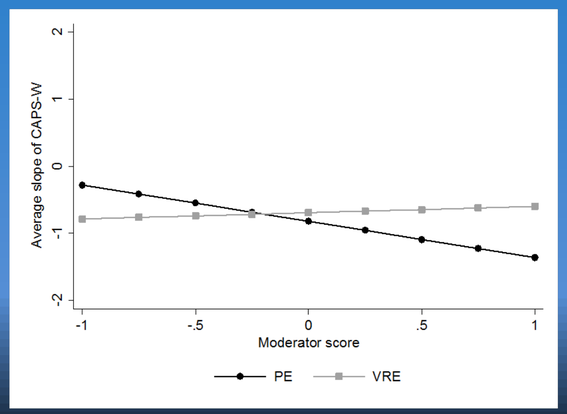
- All variables were standardized and Individual moderator effects were calculated (Table 1).
- Principle-components analysis was used to identify factors of the moderators.
- A single individual moderator was selected to represent each factor in the creation of the combined moderator M^*.
- Multiple regression was used to determine the weight for each individual moderator in M^* (Table 1).
- Predicted treatment outcomes were used to determine the cut point for which VRE is superior to PE and visa versa (Figure 1).
- Individual moderator profiles were calculated for groups split by predicted treatment superiority (Table 2).

RESULTS

Table 1. Individual moderator effect size estimates and weights for moderators included in the calculation of M^*

Potential contributing moderator	Effect size estimate	95% CI	Weight in M*
Baseline PCL-D	-0.11	-0.13, -0.08	-0.42
Baseline use of antidepressants	0.10	0.07, 0.12	0.29
Two-year college degree or more education	0.09	0.07, 0.11	
Prior psychological treatment for PTSD	-0.07	-0.10, -0.05	
Age	0.06	0.04, 0.09	0.34
Baseline suicide risk assessment (any/none)	-0.05	-0.07, -0.01	-0.15
Baseline use of other psychotropic medications	0.05	0.02, 0.07	
Baseline substance abuse	0.04	0.01, 0.07	
Baseline PCL-B	0.04	0.02, 0.07	
Junior enlisted (E1 – E4)	-0.04	-0.07, -0.02	
Baseline BDI	0.04	0.02, 0.08	
Baseline PCL-C	0.03	0.00, 0.06	
Baseline BAI	0.02	0.01, 0.06	
Trauma alignment to virtual reality	-0.02	-0.04, 0.01	
Race/ethnicity other than non-Hispanic white	0.01	-0.01, 0.05	
Baseline use of benzodiazepines	0.00	-0.02, 0.04	
Marital status	0.00	-0.03, 0.02	
History of three or more deployments	0.00	-0.02, 0.03	

Figure 1. Slope of PTSD symptom change from baseline to post treatment, by assigned treatment group, over a range of M^* scores. The intersection occurs at M^* = -0.20.



RESULTS (cont.)

Table 2. Distribution of individual moderator variables by M^* range labeled by predicted superior treatment

Individual moderator	VRE (M^* < - .21) n = 40	PE (M^* ≥ - .21) n = 68
PCL-D (Hyperarousal Sxs)	4.4 (0.5)	3.7 (0.6)
Antidepressant Use	15.0%	64.7%
Age	26.8 (4.8)	32.2 (7.0)
Suicide Risk Assessment	25.0%	11.8%
Treatment Effect Size	-.41 (-1.22, .40)	-1.08 (-2.07, -.08)
Difference in CAPS decrease	-6.66 (-19.83, 6.50)	-17.55 (-33.64,-1.30)

DISCUSSION

- Individuals who were predicted to see greater PTSD symptom reduction in VRE were likely to be younger, not taking antidepressant medication, had greater PTSD hyperarousal symptoms, and were more likely to have greater than minimal suicide risk.
- Predicted difference in treatment response between VRE and PE for each individual was significant for those predicted to respond better to PE, but not for those predicted to respond better to VRE.
- Though speculative, it is possible that VRE helps facilitate emotional engagement among individuals with higher levels of hyperarousal symptoms due to problems with under-engagement during imaginal exposure.
- There are significant limitations to the current study including the data-driven nature of the analytic approach and the potential lack of generalizability to other samples. Until further research is conducted these results should not be used in making clinical determinations.
- However, by capitalizing on the increased power to detect moderation effects through the generation of a combined moderator these results provide initial insight into the potential profile of individuals who may respond better to either VRE or PE.

REFERENCES & DISCLAIMER

1. Foa, E. B., Hembree, E. A., & Rothbaum, B. O. (2007). *Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences: Therapist guide*. New York, NY: Oxford University Press.
2. Foa, E. B., Huppert, J. D., & Cahill, S. P. (2006). Emotional processing theory: An update. In B. O. Rothbaum (Ed.), *Pathological anxiety: Emotional processing in etiology and treatment* (pp. 3–24). New York, NY: Guilford Press.
3. Parsons, T. D., & Rizzo, A. A. (2008). Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry, 39*, 250–261.
4. Reger, G. M., Holloway, K. M., Candy, C., Rothbaum, B. O., Difede, J., Rizzo, A. A., & Gham, G. (2011). Effectiveness of Virtual Reality Exposure Therapy for Active Duty Soldiers in a Military Mental Health Clinic. *Journal of Traumatic Stress, 24*, 93-96.
5. Reger, G. M., Koenen-Woods, P., Zetocha, K., Smolenski, D. J., Holloway, K. M., Rothbaum, B. O. . . Gahm, G. A. (2016). Randomized controlled trial of prolonged exposure using imaginal exposure vs. virtual reality exposure in active duty soldiers with deployment-related posttraumatic stress disorder (PTSD). *Journal of Consulting and Clinical Psychology, 84*, 946-959.
6. Wallace, M. L., Frank, E., & Kraemer, H. C. (2013). A novel approach for developing and interpreting treatment moderator profiles in randomized clinical trials. *JAMA Psychiatry, 70*, 1241-1247.
7. Kraemer, H. C. (2013). Discovering, comparing, and combining moderators of treatment on outcome after randomized clinical trials: a parametric approach. *Statistics in Medicine, 32*(11), 1964-1973.