The Effectiveness of Various Enhancements to Exposure Therapy for PTSD

Harlow Janssen, Tiffany Crawshaw
Laguna Beach High School

INTRODUCTION

My research will be a meta-analysis examining exposure therapy and whether adding the additional methods, Ketamine, Transcranial Magnetic Stimulation, Virtual Reality, and D-cycloserine, increases or decreases the effectiveness of exposure therapy for post-traumatic stress disorder.

RESEARCH METHODOLOGIES

First, I analyzed traditional exposure therapy as a baseline. Then, examined four additional methods—ketamine, TMS, virtual reality, and D-cycloserine—by reviewing studies on their independent effects, including therapeutic outcomes, mechanisms, and limitations.
Next, this study evaluated studies combining these methods with exposure therapy in patients with PTSD.
Finally, this study will present a comparative graph showing which approaches produce the strongest results.

Data was collected from peer reviewed sources and analyzed using symptom severity scales (pre/post), engagement, speed of response, and long-term outcomes.

DISCUSSION, ANALYSIS, AND EVALUATION

From my data, I concluded that traditional prolonged exposure therapy combined with additional methods can increase the effectiveness for patients with PTSD.

Limitations of my paper were the small sample size used in the data I analyzed. Most of the data I analyzed used small sample sizes, and some did not have long follow-up periods. Long-term follow-up remained limited, limiting generalizability. Future research should focus on larger randomized trials and explore personalized treatment approaches based on individual neurobiological profiles.

Ketamine:
Rapid-acting NMDA receptor used to enhance neuroplasticity and reduce PTSD symptoms; supports fear extinction when combined with exposure therapy.

D-Cycloserine: Partial NMDA receptor agonist used to facilitate fear extinction learning; intended to enhance exposure therapy, though results are inconsistent.

Transcranial Magnetic Stimulation (TMS): Non-invasive brain stimulation technique that targets the prefrontal cortex to regulate fear responses associated with PTSD.

Virtual Reality Exposure (VRE): Immersive technology used to simulate trauma-related environments, allowing controlled exposure.

DATA AND FINDINGS

Treatment condition	Exposure Therapy (alone)	Exposure Therapy + Ketamine	Exposure Therapy + D-cycloserine
Symptom Reduction	Significant symptom reduction	Large reductions (d≈1.2–1.9); ↓ CAPS-5 & PCL-5; ~69–77% response in some trials	CAPS: no significant group difference.
Participation	Low dropout (21–34% massed; ~50% weekly)	Preliminary evidence suggests improved engagement and adherence,	No consistent dropout reduction.
Longevity & Durability	Strong long-term durability; majority no longer meet PTSD criteria at multi-year follow-up	Rapid improvement (1–2 weeks); some effects last up to ~6 months; unclear long-term.	No significant 12-month difference vs placebo. (learning-dependent)

Treatment condition	Exposure Therapy (alone)	Exposure Therapy + TMS	Exposure Therapy + Virutal Reality
Symptom Reduction	Significant symptom reduction for individuals with PTSD	CAPS 88→61 (−27); improved intrusion/hyperarousal; ↓ amygdala (DLPFC)	Moderate effect (g≈0.33; inactive g≈0.57); ~50–75% reduction; ~67% PCL drop
Participation	Low dropout (21–34% massed; ~50% weekly)	Treatment-refractory populations. No clear dropout advantage reported.	High engagement; helpful for imaginal difficulty; dropout similar; 6–12 sessions
Longevity/ Durability	Strong long-term durability; the majority no longer meet PTSD criteria at 6 month follow up	Short-term (4 weeks). Limited long-term data. over	Sustained symptom reduction at 6-month follow-up (g = 0.848).

Treatment condition	Symptom Reduction	Participation	Longevity/Durability
VRE + D-cycloserine	Post g= 0.68 (NS). 6 month: g= 1.13 (p=.01) Remission: 46% vs 8% (post): 69% vs 17%(6 mo). Earlier improvement by session 6 (-46% vs -30%)	No consistent improvement in dropout or engagement reported”	Large 6-month effect (g= 1.13) Sustained remission advantage vs placebo

Color Key
Significant improvement with strong support
Moderate improvement
Limited or variable improvement
No statistically significant improvement

CONCLUSIONS, IMPLICATIONS, AND NEXT STEPS

Conclusion: Ketamine combined with prolonged exposure (PE) demonstrated the largest overall effect size across studies (PCL-5 $d \approx 1.44$; CAPS-5 $d \approx 1.22$), indicating substantial symptom reduction. Clinically, PCL-5 scores decreased from approximately 55 to 27, reflecting a meaningful improvement in PTSD severity. Compared to ketamine alone (effects lasting ~1 month), the combination with PE extended durability up to approximately 6 months.Ketamine’s neurobiological mechanisms—specifically increased synaptic plasticity and strengthened amygdala–prefrontal connectivity— support fear extinction processes central to exposure therapy.

Implications: These findings are significant given the rising prevalence of PTSD in the United States and limitations of standard treatments. The results suggest that adjunctive interventions can enhance the effectiveness of exposure therapy by improving symptom reduction, engagement, and treatment durability.

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***QR CODE TO FULL PAPER: