



A U.S. Army soldier surveys a small village near Forward Operating Base Salerno in Afghanistan on 3 February 2012. (Photo by Spc. Ken Scar, U.S. Army)

Integrating EMDR Therapy and New Technologies to Enhance Combat Resilience

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In modern military operations, psychological resilience has become essential to mission accomplishment and service members' well-being. Combat environments subject military personnel to extreme stress and trauma, which can result in long-term psychological repercussions including posttraumatic stress disorder (PTSD). Military personnel are exposed to unique challenges that can significantly impact their mental health. While combat, dangerous missions, and severe training incidents are well-known contributors, veterans experience PTSD at a slightly higher rate than civilians, approximately 7 percent versus 6 percent in the overall population.¹ The prevalence is higher among female veterans, with 13 percent affected versus 6 percent of their male counterparts.² The likelihood of developing PTSD varies across different service eras, with the highest rates seen in veterans from Operations Iraqi Freedom and Enduring Freedom, where nearly 29 percent experienced PTSD at some point in their lives.³

PTSD can arise from combat experiences that involve life-threatening situations, either to oneself or others, such as witnessing someone being injured by bullets or shrapnel, facing the enemy at close quarters, encountering corpses, inhaling toxic gases, being at risk of death, feeling powerless to alter living conditions, or seeing destruction like ruined buildings and machinery.⁴ Acts such as physically killing an enemy can also contribute to the onset of PTSD.⁵ Such traumatic experiences, when accumulated over time, can significantly increase the likelihood of PTSD in veterans, intensifying the psychological burden of military service.

The mental health of military veterans, especially concerning PTSD, remains a persistent issue. Not all military personnel exposed to trauma will develop PTSD. For instance, having high resilience may make it easier to tolerate the negative feelings associated with trauma exposure and to respond adaptively after being exposed to it, both of which may improve psychological health.⁶ Veterans benefit from prevention and therapy that foster resilience, a strong sense of purpose in life, and close relationships with others.⁷ While combat-related trauma is a primary contributor to PTSD among veterans, other significant factors also come into play.⁸ These include premilitary experiences such as childhood adversity and socioeconomic challenges, which can increase vulnerability to PTSD.

The impact of factors like early-life difficulties, social class, and trauma before military service can intensify PTSD symptoms or even be pivotal in their development. Timothy Carroll et al., for instance, discovered that over 80 percent of veterans who had served in the Iraq and Afghanistan wars reported having at least one adverse traumatic event in their childhood.⁹ Additionally, around 40 percent of those surveyed had endured four or more traumatic events throughout their lives.¹⁰ Addressing these early-life adversities is crucial in the treatment and support of veterans coping with mental health challenges because such early traumas may contribute to increased vulnerability to PTSD. Repeated exposure to these combat-related stressors can heighten the sensitivity to future trauma or weaken coping mechanisms. Individuals who have already faced traumatic events may have an increased vulnerability to PTSD when exposed to additional stress, as previous traumas can leave lasting impacts on their mental health.¹¹ This highlights the complexity of PTSD nature and the importance of understanding the diverse experiences that contribute to PTSD to provide more tailored and effective mental health support for active military personnel and veterans.

The Growing Role of EMDR Therapy in Military Mental Health Care

As the landscape of mental health interventions for military personnel continues to evolve, a growing number of active-duty military personnel and veterans are being treated for trauma-related disorders with eye movement desensitization and reprocessing (EMDR) therapy. The need for efficient, easily accessible, and scientifically supported treatments is critical, given the nature of war and the psychological effects of combat. Initially developed to address PTSD, EMDR has emerged as a valuable therapeutic approach within military mental health care.¹²

EMDR is based on the adaptive information processing model, which suggests that the brain can heal by reprocessing maladaptively stored traumatic memories. When memories are improperly processed, they remain raw, unprocessed, and disconnected from adaptive information, leading to problematic reactions. A PTSD sufferer's exaggerated startle reaction, for instance, in response to a firework that might sound like a gun, could serve as an example.¹³ EMDR helps



reprocess such memories by focusing on the distressing event, associated negative beliefs, and physical sensations, allowing for the formation of new neural connections. This integration helps reduce symptoms like intrusive thoughts and exaggerated responses by linking the traumatic memory with healthier, adaptive material. In EMDR, unresolved trauma memories are considered the root of PTSD and related mental health issues. The therapy employs structured techniques, including bilateral stimulation, which involves stimuli (visual, auditory, or tactile) occurring in a rhythmic left-right pattern. This engages the brain's natural adaptive information processing system, facilitating the resolution of traumatic memories and emotions. This process leads to an adaptive outcome and alleviation of PTSD and other symptoms.¹⁴

The effectiveness of EMDR in treating PTSD is well-documented in existing research.¹⁵ Studies have consistently demonstrated that EMDR can help reduce the intensity of trauma symptoms in veterans who have combat-related PTSD. For example, a randomized controlled trial by John Carlson et al. showed that EMDR led to significant symptom reduction in veterans with long-standing PTSD, outperforming

A U.S. Army soldier in a moment of reflection embodies resilience amid the mental toll of service. (Photo by RDNE Stock Project via Pexels)

other interventions.¹⁶ Similarly, a meta-analysis by Ying-Ren Chen et al. emphasized the consistent efficacy of EMDR in comparison with other trauma-focused treatments, reinforcing its suitability for military personnel.¹⁷ Other research has also constantly identified that EMDR therapy provides similar or better treatment outcomes than conventional therapies.¹⁸

One of EMDR's most notable military advantages is its relatively short treatment duration. EMDR therapy in military personnel has been shown to yield significant improvements in combat-related stress disorder within a few sessions.¹⁹ This makes it a crucial therapy for military personnel, who often have limited time for long-term treatment and may need rapid, effective interventions on the battlefield before redeployment or upon their return home. Furthermore, EMDR therapy's neurobiological foundation supports its suitability for military trauma. Research shows that EMDR stimulates bilateral brain activity, helping to integrate

traumatic memories with nontraumatic experiences and allowing for emotional processing and memory reconsolidation.²⁰ For soldiers who often experience disjointed or fragmented memories due to the high-stress nature of combat, this aspect of EMDR can be particularly beneficial. It facilitates the desensitization of distressing memories, transforming them into manageable, coherent narratives that no longer trigger overwhelming emotional responses.

Moreover, EMDR therapy aligns well with the practical demands of military field environments. While its traditional format involves eight structured phases, some adapted versions like the recent traumatic event protocol (R-TEP) allow for condensed sessions focusing specifically on distressing combat memories.²¹ Such early EMDR interventions also recognize that recent traumatic memories differ from older ones as they may be fragmented and not yet fully consolidated. This adaptability is crucial in military settings where

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soldiers might not have the luxury of regular access to mental health care. In situations where traditional therapeutic environments are unavailable, EMDR can be modified to fit the needs of soldiers in operational environments or during debriefing periods. R-TEP is a structured approach for early intervention that integrates elements from previous EMDR protocols.²² R-TEP targets traumatic events over an extended period, known as the “trauma episode,” which spans from just before the trauma began to the present. It is used for life-changing events with ongoing effects, viewed as part of a trauma continuum. In

R-TEP, the individual focuses on disturbing memory fragments or points of disturbance, processing each with EMDR techniques until the distress is significantly reduced. Instead of treating the traumatic event as a single memory, it can be broken down into distinct moments that serve as individual targets for treatment.²³

Elan Shapiro and Brurit Laub demonstrated in a randomized controlled experiment that R-TEP was successful in lowering PTSD symptomatology among seventeen survivors of a hostile attack in their community throughout a two-day therapy.²⁴ Similarly, past research has yielded fruitful results. EMDR R-TEP was implemented to treat survivors following terrorist bombings.²⁵ Three 120-minute sessions effectively addressed two to three traumatic targets, with the positive outcomes maintained at a six-month follow-up.²⁶ In addition, two randomized controlled trials conducted with Syrian refugees found that EMDR R-TEP significantly reduces PTSD and depressive symptoms.²⁷

Research by Matthew Wesson and Matthew Gould highlighted how modified EMDR protocols could be successfully applied in military environments, suggesting its potential as a field-deployable therapeutic option.²⁸ Their case study described using the EMDR R-TEP with a twenty-seven-year-old active-duty UK soldier experiencing acute stress after treating a land mine casualty. Conducted two weeks post-trauma, the intervention included four daily sessions, leading to a significant reduction in adverse symptomatology that allowed the soldier to promptly return to frontline duties with the results sustained at the eighteen-month follow-up.

Another EMDR protocol, the group traumatic episode protocol (G-TEP), is an EMDR approach tailored for groups who have encountered similar or distinct traumatic experiences. It applies to both recent traumatic incidents (e.g., Derek Farrell et al.) and ongoing significant life events that may not be recent, such as the situations faced by refugees.²⁹ A fundamental aspect of G-TEP is that individuals are not required to share any specifics about their traumatic experiences. Referred to as “blind to therapist,” this technique has various benefits in EMDR therapy.³⁰ Memories of trauma that arouse feelings of shame, survivor guilt, moral harm, or anxieties about blame and stigma could be the justification for keeping information private.

In military settings, this approach can be particularly beneficial for soldiers who have experienced combat-related trauma. By allowing service members to participate in therapeutic sessions without detailing their experiences, G-TEP can foster a sense of safety and trust within the group. This nondisclosure can help reduce the potential for shame or judgment, promoting participant openness and connection. Furthermore, addressing moral injury—whether tied to personal core values or external factors like betrayal—can facilitate healing and resilience. By focusing on shared experiences and collective recovery, soldiers can build a supportive community that enhances their emotional strength and coping strategies, ultimately promoting resilience in the face of ongoing challenges.

However, despite promising clinical experiences and preliminary controlled studies, researchers indicate that significant gaps remain in the evidence supporting EMDR as an early intervention.³¹ They underline that, above all, future studies should follow the strictest guidelines for clinical methodology, with a particular focus on determining whether EMDR early intervention could prevent PTSD from developing and improve people's resilience.³² This suggestion is in line with the need for further development in military mental health treatment, where EMDR is still underutilized despite its demonstrated advantages. A dearth of qualified EMDR therapists in the military and concerns about its efficiency compared to more traditional methods could be factored into this insufficient use. However, as military psychology advances, it may be possible to greatly enhance the results for troops who have experienced trauma connected to battle by incorporating EMDR into conventional military mental health services.

In this context, the World Health Organization has widely recommended EMDR as a frontline treatment for PTSD, highlighting its evidence-based success across various populations, including veterans.³³ EMDR therapy has also been recommended for treating PTSD by several organizations, including the U.S. Departments of Veterans Affairs and Defense, the International Society for Traumatic Stress Studies, and the National Institute for Healthcare Excellence.³⁴ As military forces increasingly seek scientifically validated methods to enhance soldiers' mental health, the expanding body of evidence supports EMDR as a

compelling option for incorporation into military mental health services.³⁵

Another area of concern is that although evidence-based therapies such as EMDR and other related exposure treatments have shown considerable success in treating PTSD, a subset of patients consistently fails to respond, even after multiple therapeutic interventions.³⁶ This condition, referred to as treatment-resistant PTSD, remains poorly understood, with limited research specifically focused on these individuals.³⁷ As a result, there is an urgent need for innovative treatment approaches, especially in the military, where personnel are more susceptible to combat-related stress disorders ramifications.

Breaking Barriers: How Tech-Enhanced EMDR Therapy Is Supporting Resilience and Healing in Military Personnel

Recent advances in technology like virtual reality (VR), artificial intelligence (AI), and wearable devices seem to have opened new possibilities for enhancing the reach and effectiveness of EMDR therapy, making it more accessible and adaptable to the unique challenges of combat. Virtual reality exposure therapy (VRET), for instance, has gained considerable attention as a means of enhancing traditional trauma treatments by immersing patients in controlled, simulated environments that replicate combat scenarios.³⁸ VRET offers a solution to the challenge many individuals encounter when trying to recall traumatic memories, potentially enhancing therapeutic participation vividly. It also overcomes the issue of selecting suitable stimuli for gradual exposure. With VRET, the primary limitation lies in the software's capabilities, which can be customized to create virtual settings tailored to the specific needs of each participant.³⁹

When combined with EMDR, VR allows for a more targeted reprocessing of traumatic memories that are directly tied to combat experiences. A recent randomized controlled trial by Marieke van Gelderen et al. demonstrated the effectiveness of combining VRET and EMDR in reducing PTSD symptoms in veterans with a history of four unsuccessful treatments, and multimodal motion-assisted memory desensitization and reconsolidation (3MDR) has emerged as a promising candidate to address this challenge.⁴⁰



A digital illustration of the 3MDR setup. The hardware includes a dual-belt treadmill, a 180° projection on three screens by three projectors, and a surround sound system. The software consists of a purpose-built virtual environment to walk in, personalized for each patient with images and music selected by patients. Participants wear a harness while on the treadmill for safety. The therapist stands alongside the veteran while a junior psychologist operates hardware and software. (Figure from Marieke J. van Gelderen et al., "Perceived Treatment Processes and Effects of Interactive Motion-Assisted Exposure Therapy for Veterans with Treatment-Resistant Posttraumatic Stress Disorder: A Mixed Methods Study," *European Journal of Psychotraumatology* 11, no. 1 [2020])

3MDR is highly regarded for its effectiveness in treating PTSD.⁴¹ It promotes memory retrieval, patient engagement, and focused attention by incorporating multisensory inputs like personalized images and music, which heighten emotional involvement and therapist guidance to facilitate the processing of traumatic memories.⁴² Research indicates that physical movement during 3MDR, as patients navigate toward self-selected trauma-related images in a virtual environment, supports fear extinction more effectively than sitting.⁴³ This approach contrasts with the avoidance response common in PTSD, encouraging an approach-oriented reaction and fostering divergent

thinking.⁴⁴ The 3MDR protocol includes projecting tunnels and patient-chosen images associated with their trauma, integrated into the treatment software.⁴⁵ Chelsea Jones et al. showed that 3MDR helped military veterans who were not responding to PTSD treatment.⁴⁶ Emily Tang et al. also highlighted positive effects on emotional regulation through cognitive-motor stimulation, narrative involvement, divergent thinking, and reprocessing traumatic memories.⁴⁷

Robert McLay et al. studied eighty-one active-duty service members with PTSD.⁴⁸ They found significant PTSD symptomatology reductions after twelve weeks of 3MDR therapy, though results were similar to a control group that viewed moving images on a screen.⁴⁹ Jonathan Bisson et al. and Gelderen et al. applied a similar protocol with forty-two veterans selecting trauma-related images. Both studies show notable PTSD reduction in the 3MDR groups compared to wait-list and nontrauma treatment controls.⁵⁰ In addition, a 2022 randomized controlled trial has highlighted the significant clinical improvement in PTSD symptoms among military service members, with or without mild traumatic brain injury, following 3MDR treatment.⁵¹ Participants showed strong engagement with the 3MDR approach, which contrasts with historically high dropout rates (20–50

percent) in PTSD treatment trials due to trauma avoidance. The unique features of 3MDR, including using a virtual environment, treadmill walking, eye movement tasks, and personalized music and images, likely contributed to its appeal and effectiveness.⁵²

Finally, a recent review conducted in 2024 highlighted why 3MDR is effective in the treatment of PTSD in military populations.⁵³ It also addressed significantly improved moral injury and emotion regulation, sleep quality, and access to trauma-related memories. Researchers highlighted that the effectiveness of 3MDR related initially to physical movement during therapy sessions, which activates neural circuits associated with memory and emotion, aiding in the desensitization and reconsolidation of traumatic experiences.⁵⁴ The immersive nature of “walking into memories” enhances trauma processing, organization, and integration, while the therapist’s role is crucial in supporting patients to confront trauma and reduce avoidance.⁵⁵ This can be particularly beneficial for military personnel, who often deal with vivid memories tied to physical actions and environments.

Additionally, the simultaneous exposure to trauma-related cues within a controlled setting allows for safe reexperiencing and restructuring of maladaptive memory patterns. The combination of these elements not only addresses the psychological aspects of PTSD but also engages physiological processes, potentially leading to improved symptom management and overall psychological resilience.⁵⁶ Concerns about accessibility for veterans with physical disabilities suggest adaptations like modified treadmills, while AI applications could mitigate cost-effectiveness challenges. Health economic evaluations are necessary to determine whether 3MDR’s benefits justify the expenses, especially if the therapy is to be expanded beyond its current niche for treatment-resistant PTSD.⁵⁷

In addition, AI is increasingly used in diagnosing and treating PTSD by analyzing data from soldiers recounting devastating experiences in combat.⁵⁸ To identify predictive trends in intonation, speed, and word frequency, AI applications passively observe and analyze patterns of speech, facial expressions, and body motions using natural language processing algorithms.⁵⁹ Additionally, cameras capture physical activity and eye movements to assess emotional states. Post-diagnosis, wearable devices continuously collect

data such as sleep quality and behavior through GPS monitoring and analyze smartphone interactions like keystroke speed. AI-driven diagnostic tools use deep learning and supervised machine learning to refine PTSD diagnoses and suggest personalized therapies, offering real-time assessments and potential suicide risk notifications to therapists.⁶⁰

AI-driven platforms are also transforming how EMDR is delivered. AI can analyze data from EMDR sessions, tailoring therapy to an individual’s emotional and physiological responses. Recent research has shown that AI-supported EMDR therapy can increase the precision of interventions and enhance treatment outcomes. For instance, researchers created an actuator-based EMDR virtual system that has been developed by incorporating the system. The system could operate independently with an AI chatbot, video, haptic, and audio actuators.⁶¹ The results showed how well the EMDR virtual assistant reduced anxiety, discomfort, and unpleasant feelings and thoughts in participants with past traumatic memories. Although the absence of a therapist raises many ethical concerns and needs to be further addressed, such integration of AI enables real-time monitoring of a soldier’s emotional state, tailoring EMDR interventions to their specific needs. These tools and innovations can be combined with real-time therapists’ assistance and could be especially beneficial in high-pressure combat situations where immediate psychological support is necessary and critical to maintaining mental resilience.⁶²

Empowering Minds: Transforming Trauma Recovery for Soldiers Through Innovative Therapeutic Strategies

As military operations become more complex and stress-inducing, it is crucial to continue exploring innovative technologies that enhance the effectiveness of therapies like EMDR. By doing so, we can ensure that soldiers have the psychological tools to remain resilient in modern combat challenges. Advanced treatments such as 3MDR, which combine immersive virtual environments with motion and personalized stimuli, have demonstrated significant promise in engaging patients and fostering emotional processing. Additionally, integrating AI into diagnostic and therapeutic platforms



The 3MDR therapy for military veterans shares many of the principles and methods used in existing therapies but extends these using virtual reality techniques including adding in a veteran's choice of music and photographs and walking on a treadmill. (Screenshot from Cardiff and Vale University Health Board via YouTube)

provides real-time analysis and adaptation, potentially revolutionizing mental health care for military personnel in both field and clinical settings. Future research should focus on refining these technologies and developing new approaches that address the unique demands of military trauma, ensuring that treatments remain accessible, adaptable, and effective in various operational environments. The combination of EMDR with cutting-edge tech can pave the way for more resilient soldiers, reducing the long-term psychological burden of combat.

Future interventions for the battlefield may integrate EMDR-assisted technologies to deliver immediate mental health support to active-duty soldiers experiencing trauma in real-time combat situations, ultimately reducing the risk of developing PTSD and fostering overall psychological resilience. These interventions could include a portable VR setup that equips mental health professionals with rugged VR headsets for ease of transport and setup in various battlefield environments. The VR system would feature an

extensive library of immersive environments tailored to the unique traumatic experiences of military personnel, such as combat engagements, ambush situations, or emergency evacuation scenarios.

Following a traumatic event, soldiers could participate in a therapy session led by a trained mental health professional. During these sessions, the therapist would guide soldiers through EMDR therapy. At the same time, they interact with the relevant VR scenarios, providing a controlled yet realistic context for safe exposure and trauma processing. To further enhance the therapeutic experience, the intervention would incorporate AI-powered monitoring and adaptive features using wearable devices to continuously track soldiers' physiological responses, including heart rate and galvanic skin response. AI algorithms would analyze this data in real time to provide therapists with insights into the soldier's emotional state, enabling them to adjust the intensity of the exposure or modify the therapeutic approach to suit the individual's needs.

These interventions could also utilize EMDR protocols specifically designed for military personnel and tailored to their needs. For recent acute traumas, protocols such as the R-TEP could be applied to address distressing experiences soon after they occur, helping to prevent the consolidation of trauma into long-term psychological disorders. For collective trauma

experienced by groups of soldiers, the G-TEP could be used to facilitate a shared therapeutic process that helps normalize reactions to trauma, foster group cohesion, and build resilience. By adapting these protocols to the unique demands of military service, therapy can be made more effective and relevant for soldiers who must continue to operate in high-stress environments.

Autonomous EMDR systems represent a significant advancement in mental health support for military personnel, particularly in high-stress environments where access to mental health professionals may be limited. These systems can facilitate semiautonomous therapeutic interventions, combining AI-driven technology with the critical oversight of a human therapist. In this model, the therapist remains an integral component of the process. At the same time, the AI manages various aspects of the therapy session—pacing, monitoring physiological responses, and creating virtual environments for exposure. They conduct initial assessments to determine the soldier's suitability for AI-assisted therapy, provide guidance and oversight during sessions, and tailor interventions to meet individual needs. This collaboration ensures that soldiers receive immediate support for processing trauma soon after exposure, which can help prevent the development of more severe psychological conditions. However, ethical considerations must be prioritized in implementing autonomous EMDR, including patient safety, confidentiality, and maintaining the essential human element in therapy. By blending advanced technology with personalized care, semiautonomous EMDR holds the potential to revolutionize mental health support

for military personnel, making it more accessible and effective in addressing the complexities of trauma.

Alongside the therapy, soldiers could access integrated support resources, including mindfulness exercises, grounding techniques, and coping strategies through a companion mobile app. This app can also facilitate peer support by connecting soldiers with others who have undergone similar experiences, fostering a sense of community and reducing isolation. To implement this intervention, therapists will be trained to use VR and AI technologies effectively, emphasizing the unique challenges of providing mental health support in combat situations.

A future pilot program could be launched within a specific unit or deployment, collecting data on the intervention's effectiveness and gathering feedback from soldiers and therapists to refine the approach. Collaboration with military leadership will be crucial to integrate this intervention into existing mental health support structures, ensuring it complements other resources and support available to soldiers. Continuous evaluation and improvement will be established through a feedback loop to assess the effectiveness of the intervention, making adjustments based on soldier and therapist experiences to enhance its impact. By leveraging cutting-edge technology, this intervention may facilitate effective trauma processing in real-time, reducing the risk of PTSD and promoting resilience among active-duty personnel. Integrating such an innovative approach into military mental health care can ultimately enhance the well-being of service members and support their ongoing mission readiness. ■

Notes

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