



Memory Deficits in Post-traumatic Stress Disorder

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Abstract. This paper mainly analyzed the memory deficits and its influences in Post-Traumatic Stress Disorder (PTSD). PTSD is a prevalent illness, and it has a destructive impact on daily functioning of patients. The main issue of patients who are suffering from PTSD is having problems in the memory system. For instance, typically developing people are able to forget the traumatic event and adjust their memory properly. Patients with PTSD have difficulties in this process. This review first showed the evidence of the influential relationship between memory and PTSD, which suggests some memory impairment existing in PTSD patients. In addition, it also discussed some impairment of memory regulation in PTSD, such as difficulties in suppressing negative memories and keeping their memories updated. Finally, this paper discussed different types of trauma-related memory processing in PTSD, such as emotional working memory capacity, fear memory, and fragmented trauma memories. In summary, this review shows evidence regarding memory deficits that are related to PTSD patients. One limitation of previous studies is that they are mostly cross-sectional studies. Future research should conduct more longitudinal studies, to understand the long-term impact of memory deficits on PTSD. This review can provide guidance to intervention programs for patients with PTSD.

Keywords: Post-Traumatic Stress Disorder · Memory Impairment · Intervention · Memory Suppression

1 Introduction

Post-Traumatic Stress Disorder (PTSD) is a very common illness that exists in the society, and many people suffer from it. PTSD is a mental condition characterized by intrusive thoughts about a traumatic event, recurring anguish or anxiety, flashbacks, and avoidance of comparable settings that are related to the traumatic event [1]. Naturally, nearly everyone would experience a range of reactions after suffering from a certain extent of trauma. However, if someone continuously undergoes the trauma-related stress, they may be diagnosed with PTSD. A number of research has been done regarding the diagnostic criteria of PTSD [2]. The relationship between PTSD and memory is still controversial. According to some reports, PTSD influences the human memorizing system. It is important to understand this relationship further.

There are some general symptoms and signs that could help people recognize PTSD. There are four types of symptoms: disorders of re-experiencing, avoidance, arousal and reactivity, and cognitive and emotional symptoms [1]. In order to be diagnosed with PTSD, a person must have at least one re-experiencing or avoidance symptom for at least one month, as well as at least two arousal and reactivity symptoms, or two cognition and mood symptoms. Flashbacks, horrible nightmares, and terrifying thoughts are some of the re-experiencing symptoms [3]. These symptoms all mean that a person who submerges in the trauma feels themselves experiencing the horrible trauma repetitively. It often starts from the things or situations that the person sees, feels, or thinks [1]. For example, if a person who almost drowned in the past sees the ocean, he would be reminded of the horrible memory of the trauma. Staying away from locations, activities, or items that are reminders of the traumatic experience, as well as avoiding thoughts or sensations associated to the traumatic incident, are examples of avoidance symptoms. This type of symptom is always related to a person's attempts to avoid the traumatic event that he or she used to experience. For example, a person who used to go through an accidental fire, tries to avoid all the settings that are associated with the fire.

Being easily startled, feeling tense or on edge, having trouble sleeping, and having furious outbursts are all arousal and reactivity signs of PTSD [1]. This type of symptom often makes people feel anxious, stressed, and overwhelmed, so they would probably have difficulties with daily life tasks. Last but not least, there are cognitive and emotional symptoms in PTSD, such as difficulty in recalling essential details of the traumatic incident, unpleasant views about oneself or the world, distorted feelings like guilt or blame, and a loss of interest in enjoyable activities. People who experience this type of symptom often feel alienated or distant from their friends and family. For all four types of symptoms described above, it is normal that these symptoms exist in people's behavior, but if it exists for more than one month and affects people's function severely, it should be diagnosed as PTSD.

Although people may easily experience PTSD, they could protect themselves and prevent themselves from PTSD or worse conditions, by noticing some risk factors and avoiding it. There are some factors that may enhance the severity of PTSD [1]. For example, living in an unsafe environment and always getting hurt, seeing some brutal and bloody scenes, having an unhappy childhood, lack of love and support, having heritable mental illness history, can all contribute to the risk of PTSD. Although people have these risk factors that would lead to a worse illness, there are also some resilience factors and methods that can help people promote recovery, such as having the ability to seek for help and support from family or friends, trying to learn how to stay in a positive point of view and encourage oneself; and trying to deal with the fear with some strategies.

Some people may suffer from the severe level of PTSD. In this case, doctors will use some treatment to help the patients to overcome it. The most common treatment is medication. The most studied medicine for treatment is antidepressants, which may help people control their sadness, depression, stress, worry, and anger. Plus, there are some other types of medication that could be helpful for their sleeping problems. Psychotherapy, sometimes called "Talk Therapy," is a type of effective treatments as well [1]. Psychotherapy involves talking with a mental health professional to treat a mental

illness. Psychotherapy can occur in a one-on-one setting or in a group setting, and it usually lasts for 6–12 weeks or even longer. There are many types of psychotherapy, and some types may cure PTSD directly. Some psychotherapy approaches merely focus on the social or family problems. Furthermore, according to previous research, seeking support from family and friends could be effective in the process of recovery of PTSD. Different people have different levels of illness, so the doctors will combine different treatments to help different people. Cognitive-behavioral therapy, or CBT, is a type of effective treatments [1]. Exposure treatment and cognitive restructuring are two components of CBT. Exposure therapy assists people in confronting and controlling their fears. Cognitive restructuring helps people make sense of negative memories by using visualization, writing, and visiting the location where the incident occurred. Some people may feel guilty or shame about the event, in which they have negative impressions, and this therapy may help people look at the event in a realistic way. There are many types of treatment and doctors will give different treatments for different symptoms. Taking medication and receiving treatment can help people who suffer from PTSD a lot. There are also some other strategies that people can use to help themselves, such as self-protection. It may be challenging to take the first step, but people can always find a family doctor or a psychologist or searching online for the hotline to get help.

There are many symptoms and deficits in people who are diagnosed with PTSD. The early research mainly focused on the emotional part of PTSD and paid little attention to the cognitive aspect. Therefore, this review aims to understand the memory deficits in PTSD, by discussing the memory functions, memory deficits, and certain types of memory, which might negatively impact the patients' daily functioning. This review can contribute to the following intervention studies in PTSD, as a guidance.

2 Atypical Memory Functioning in PTSD

2.1 General Impairment in Short-Term and Long-Term Memory

People who suffer from PTSD probably have a problem with memories, which will even affect people's daily lives. For instance, if someone has trouble remembering things, they will probably forget important things or the things they are going to do next. People who have PTSD may have difficulties forgetting things. Since PTSD was listed on the DMS III, according to the epidemiological study, researchers demonstrated that PTSD is a prevalent diagnosis in combat veterans [4]. This comprehensive study could shed light on the learning and memory problems that accompany combat-related PTSD. Participants were asked to disclose personal information about themselves, such as their age, position, race, education, and so on, during the experiment. The Mississippi PTSD Scale, a 35-item self-report measure that assesses combat-related PTSD in veteran populations, and the Combat Exposure Scale, a 7-item self-report measure that accesses wartime stresses faced by combatants, were also administered to them. Then those people were grouped into groups. Finally, draw the conclusion through comparison [4]. The recent findings revealed that combat veterans with a diagnosis of post-traumatic stress disorder exhibit broad impairments in learning, memory, and intellectual function when compared to combat veterans without PTSD or non-combat veterans. Therefore, this research showed that PTSD patients do have impairment in memory.

In order to manifest the memory impairment in PTSD, few reports showed that there were longitudinal effects of PTSD on memory functioning. According to some research, there was an interactive effect between PTSD and the growth of ages of Holocaust survivors, and the track of longitudinal effects were still being investigated [5]. This research tested the visual and verbal memory and working memory in veterans aged between 41 and 63 to derive different measures of dependency. There are two groups: one group with 25 veterans who suffered from PTSD and another group with 22 veterans who did not have PTSD. These two groups were assessed over two-time points; the average period of the assessment was about 34 months. After the investigation, it did not show a significant change in PTSD symptoms over time. Compared to the veterans who did not have PTSD, there was only a declination of delayed facial recognition among the veterans who suffered from PTSD. In addition, this kind of decrease was very subtle [5]. Thus, this showed the track of longitudinal effects was still being discovered.

2.2 The Specific Impairment of Memory Regulation in PTSD

The reason why people may suffer from PTSD is that they have trouble forgetting the negative memories and along with the positive memory. Atypical behavioral and neurological consequences of memory suppression in PTSD are caused by the long-term preservation of negative memories [6]. Because the inability to forget is a symbolic symptom of post-traumatic stress disorder, the inability to erase unpleasant memories can play a significant role in the behavioral manifestations of the disorder [6]. The participants in this study were divided into three groups: those with PTSD, those who had been exposed to trauma but did not develop PTSD, and those who were not exposed to trauma but did not develop It first looked at the function of the latera; prefrontal cortex (LPFC) in PTSD during an event-related functional magnetic resonance imaging (fMRI) activity called the Think-No-Think paradigm, which involves a computerized presentation of 30 unrelated words, neutral visuals, and word pairings. Second, it looked at how PTSD affects trait suppression. Third, it assessed the link between trait suppression and neural processes engaged during an active state of suppression, with the goal of forecasting possible outcomes. It is concluded that PTSD victims have the deficits in suppressing their negative memories.

PTSD victims have difficulties suppressing their memory, and then they may also have difficulties updating their memory to keep their memory balanced in their memory storage. People who suffered from PTSD had trouble forgetting the materials related to the trauma. So the test assumed that the reason why PTSD patients were not able to forget things was because of the impaired updating function of working memory [7]. Therefore, it manifested that these individuals had lower working memory function of the emotional and non-emotional materials. It set a sample of the 30 male veterans who had PTSD and 30 healthy individuals after completing the PTSD Checklist, Digital span task, and a computerized n-back task commonly used to measure the effect of sleep loss on working memory. The result showed that, under the emotional and non-emotional stimuli, their working memory had no significant difference [7]. However, there was dysfunction in the working memory, including memorizing and forgetting and had influenced both in emotional and non-emotional memory. Therefore, not being able to update the memory is also an impairment of memory regulation in PTSD.

3 Impaired Emotional and Fear Memory Processing in PTSD

There are some types of traumatic memory processing in PTSD, such as emotional working memory capacity, which involves both short-term storage and executive attention control; fear memory which is critical for evaluating and responding to threatening situations; and fragmented trauma memories, and they all have been shown and proved in several research studies. For working memory capacity, it created a task for the PTSD patients and trauma-exposed controls with no PTSD history [8]. They needed to complete an emotional working memory capacity task that required them to remember lists of neutral words in a short time. In the meanwhile, they should process sentences describing dysfunctional trauma-related thoughts. This task tested the ability to use good emotional materials to complete simple and normal tasks while simultaneously dealing with heavy emotions and intrusive thoughts and feelings. As a result, compared with the group that had never been traumatized, the trauma survivors with a history of trauma had lower emotional working memory capacity. Those with mood disorders had working memory impairment and no working memory capacity deficits when facing emotional distraction [8]. Therefore, there is an impairment of emotional working memory capacity in PTSD patients.

For fear memory, it discussed how it processes and its mechanism and how this knowledge could apply in the interventions of PTSD. Fear memory was a representative model of traumatic memories [9]. The therapeutic goals for PTSD are fear memory reconsolidation, instability, extinction, and forgetting [9]. These studies suggest that humans and other advanced animals have fear memory regulation mechanisms. Furthermore, reconsolidation and extinction of fear memories have been used in the treatment of PTSD to improve extended exposure therapy, a proven strategy for healing the condition [9]. Furthermore, during the test of mice, it was discovered that forgetting fear memory was another potential therapeutic target for PTSD. Therefore, it demonstrated the existence of the fear memory and could intervene in PTSD.

Fragmented trauma memories play an essential role in PTSD. According to the fragmented theories, people who receive treatment for trauma should be accompanied by a reduction in symptoms [10]. The study looked at 77 men and women with chronic PTSD before and after therapy, comparing continuous exposure to sertraline. It compared narrative categories such as traumatic, negative, and positive using self-report, rater coding, and objective coding of narrative content by therapy and reactions [10]. In addition, it controlled the potential confounds. However, the findings indicated that fragmentation alterations may not be a critical mechanism underpinning PTSD therapy recovery. Because the fragmentation of pre- and post-treatment of PE and sertraline had no consistent differences, the sensory components increased with PE. Moreover, there are also no consistent differences between treatment responders and non-responders.

4 Conclusion

Based on the research above, there are some memory deficits in PTSD. The research in groups of veterans shows the existence of impairment in memory. Also, this study shows the track of longitudinal effects in PTSD. The research of memory suppression

in PTSD suggests that PTSD patients have deficits in suppressing negative memories. The research regarding the updating function of working memory demonstrates that patients with PTSD had lower working memory function given the emotional and non-emotional materials. Therefore, the updating memory impairment is presented in PTSD as well. In the study that compared PTSD patients with people who had never been traumatized, the results showed that trauma survivors had lower emotional working memory capacity than those who had never been traumatized. It suggests a developmental disability in emotional executive training for improving mood. The fear memory theory is a representative model of traumatic memories, and it claimed that a better understanding of the fear memory mechanisms could contribute to the treatment of PTSD. Another type of traumatic memory is fragmented trauma memories. It may be a crucial mechanism underlying PTSD therapeutic recovery. However, previous studies mostly used a cross-sectional approach, which is limited. Future studies should conduct more longitudinal research. Furthermore, most of the previous studies focused mainly on understanding the memory deficits in PTSD. Future studies should examine the effectiveness of memory related intervention for PTSD. This review can provide some guidance for the future intervention studies in PTSD.

References

1. R. Yehuda, Post-Traumatic Stress Disorder. *New England Journal of Medicine*, vol. 346, no. 2, Jan.2002, pp.108–14. <https://doi.org/10.1056/NEJMra012941>.
2. H. van Marle, PTSD as a Memory Disorder. *European Journal of Psychotraumatology*, vol. 6, Apr. 2015, p. 10.3402. <https://doi.org/10.3402/ejpt.v6.27633>.
3. E. R. de Kloet, M. S. Oitzl, E. Vermetten, Eds., *Stress hormones and post traumatic stress disorder: basic studies and clinical perspectives*, 1st ed. Amsterdam, Boston: Elsevier, 2008.
4. L. Burriss, E. Ayers, J. Ginsberg, D. A. Powell, Learning and Memory Impairment in PTSD: Relationship to Depression. *Depression and Anxiety*, vol. 25, no. 2, Feb. 2008, pp.149–57. <https://doi.org/10.1002/da.20291>.
5. K. W. Samuelson et al., Longitudinal Effects of PTSD on Memory Functioning. *Journal of the International Neuropsychological Society*, vol. 15, no. 6, Nov. 2009, pp. 853–61. <https://doi.org/10.1017/S1355617709990282>.
6. D. R. Sullivan, B. Marx, M. S. Chen, B. E. Depue, S. M. Hayes, J. P. Hayes, Behavioral and Neural Correlates of Memory Suppression in PTSD. *Journal of Psychiatric Research*, vol. 112, May 2019, pp. 30–37. <https://doi.org/10.1016/j.jpsychires.2019.02.015>.
7. V. Nejati, M. A. Salehinejad, A. Sabayee, Impaired Working Memory Updating Affects Memory for Emotional and Non-Emotional Materials the Same Way: Evidence from Post-Traumatic Stress Disorder (PTSD). *Cognitive Processing*, vol. 19, no. 1, Feb. 2018, pp. 53–62. <https://doi.org/10.1007/s10339-017-0837-2>.
8. S. Schweizer, T. Dalgleish, Emotional Working Memory Capacity in Posttraumatic Stress Disorder (PTSD). *Behaviour Research Therapy*, vol. 49, no. 8, Aug. 2011, pp. 498–504. <https://doi.org/10.1016/j.brat.2011.05.007>.
9. S. Kida, Reconsolidation/Destabilization, Extinction and Forgetting of Fear Memory as Therapeutic Targets for PTSD. *Psychopharmacology*, vol. 236, no. 1, Jan. 2019, pp. 49–57. <https://doi.org/10.1007/s00213-018-5086-2>.
10. M. Bedard-Gilligan, L. A. Zoellner, N. C. Feeny, Is Trauma Memory Special? Trauma Narrative Fragmentation in PTSD: Effects of Treatment and Response. *Clinical Psychological Science*, vol. 5, no. 2, Mar. 2017, pp. 212–25. <https://doi.org/10.1177/2167702616676581>.

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