

Can Editing Memories Provide A Treatment For Overcoming Trauma?

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Abstract. This paper reviews on how many have experienced traumatic events in their lives, walking out the shadow is an important topic. In this paper, it argues that editing memory can be a potential treatment for overcoming trauma and post-traumatic stress disorder. Scientists have found that propofol has an effect on memory, moreover, propofol can be used to erase negative emotional responses against a certain event. It is possible to edit a memory and reduce the fear towards it. Additionally, editing memory in this case only treats nondeclarative memory rather than forgetting declarative memory. Thus, it ensures ethics at the same time. Therefore, using propofol to edit memory might be a potential solution to overcoming traumatic events and the pains it brings.

Keywords: Post-traumatic stress disorder; non-declarative memory; propofol;

1. Introduction

People go through different experiences in life, both positive and negative, which shape who they are, their identity, their personality, their belief and so on. According to data from the World Health Organization, approximately 70 percent of people in the world will have traumatic experiences during their lifetime. In this 70 percent of people, a minority can get PTSD, which is a mental disorder, from that traumatic experience. Post-traumatic stress disorder, as known as PTSD, occurs when people go through a traumatic event, and still get triggered by that experience long after. Sometimes re-experiencing similar situations causes them distress. Or in other cases, they feel as if the event is happening over and over again, and gives them senses of fear and horror. The negative memories trigger them by nightmares or flashbacks, which causes them to be stuck in the recollection of the traumatic event and feel the horror. Also according to the World Health Organization, 5.6 percent of the people that experienced traumatic events developed PTSD. No matter whether the trauma developed into PTSD, it can result in mental health issues as people suffer psychological and emotional issues due to the event. That is, treating PTSD and overcoming trauma can be a challenge for many. However, scientists found that the memories can be edited in certain circumstances with certain drugs. Therefore, I will argue that editing memories can reduce negative emotions linked with the specific memories, and become a potential solution to help people overcome trauma. To support this argument, I will introduce the theory of memory editing, the experiments conducted by scientists to validate it, and whether it is practical.

Before introducing how the theory works, understanding how the memories work in the human brain is important. Memories can be categorized in two different types, which are declarative and nondeclarative memories. Declarative memories, in psychological terms, is “the ability to retain information about facts or events over a significant period of time and to consciously recall” (APA Dictionary of Psychology, n.d.). Nondeclarative memories, on the other hand, is “a collection of various forms of memory that operate automatically and accumulate information that is not accessible to conscious recollection” (APA Dictionary of Psychology, n.d.). As the definitions show, declarative memory includes facts and events; Whereas nondeclarative memory is more related to skills and emotional response that are harder to be described in words. A key thing here to notice is that a memory is composed both by declarative and nondeclarative memories. That is, when trauma occurs, the memory of an event and the negative emotions resulting from it are separated. This fact is important when speaking about the ethical problems of editing memories in the following paragraph.

Now, moving back to how the editing theory works. As mentioned in the first paragraph, it is found that memories can be edited in certain circumstances. There are overall two steps to edit a memory, to get the memory into “edit mode”, and to edit it using a drug. The drug used is called “propofol”, an intravenous anesthetic commonly used for procedural sedation (Folino et al., 2023). Propofol, according to scientists’ hypothesis, can erase the negative emotions that come with a memory. This hypothesis of propofol can be proved by an experiment done by R A Veselis 1, R A Reinsel, M Wroński, P Marino, W P Tong, and R F Bedford in 1992. However, propofol only reaches that effect when the memory is recalled and can be edited. Scientists also did experiments and found out that there are some ways to recall a memory and get it into “edit mode”. A way is to add information related to the memory. This new information makes the brain believe that the memory needs to be updated. Therefore, the brain recalls the memory and gets it into “edit mode” for updating. This is the timing to use propofol and erase the negative emotion associated with the memory.

After having a brief introduction of how the theory of editing memory works, I am going to mention how the scientist did an experiment to prove the hypothesis works. But, before I delve into the experiment on using propofol to edit memory, I am going to mention another experiment on propofol’s effect on memory. This hypothesis of propofol affecting memory can be proved by an experiment done by R A Veselis, R A Reinsel, M Wroński, P Marino, W P Tong, and R F Bedford in 1992. Ten healthy individuals were administered low doses of propofol, and they were to learn a new language. Scientists let the subject perform language learning tasks through three stages, before administering propofol, when administering propofol, and after administering propofol. They found out that nine out of the ten subjects tend to have short-term memory ability decrease when administering propofol, and they were only able to recall 50 percent of the information given during the administration when being asked. Additionally, the subjects required a stronger prompt to evoke the memory. This experiment indicated that although the subjects were still able to complete the tasks given, propofol still acted on their memories about the task significantly. This thus supports the hypothesis that propofol has the potential to function to erase an individual's memory to some extent.

Now, back to the theory of using propofol to erase negative emotional responses to a memory. The previous experiment only proved that propofol can cause memory impairment of individuals but not that it can act on emotional responses. Therefore, the next experiment I am introducing will be specifically on the topic of propofol erasing negative emotional responses. This experiment was conducted in Spain in 2019. The scientists mainly operating the experiment are Ana Galarza Vallejo, Marijn C. W. Kroes, Enrique Rey, Maria Victoria Acedo, Stephan Moratti, Guillén Fernández, Bryan A. Strange. The full introduction and data of the experiment was published on [Science Advances](#), and I will be briefly discussing how it works in the following paragraph. The researchers did the experiment on 50 individuals, and showed them two different slide shows. The two different slide shows shown to the subjects both include some unpleasant content that is purposely to create a negative memory towards the 50 individuals. A week after watching the slide shows, the individuals were asked to return to the research. The researchers recalled the negative memory of the first slide show from the 50 subjects by discussing it, and rekindled the memory so it is now in the “edit mode”. Then, scientists administered a certain dose of propofol to the subjects. At this stage, when the 50 individuals awoke, they were separated into two groups, and I will refer to them as group one and group two. Group one was asked some questions related to the negative memory and the two slide shows immediately after they woke up; On the other hand, group two was asked the same questions 24 hours after they woke up. The outcome of group one was that the 25 individuals were able to answer all the questions, and have accurate memories about the slide shows. However, the result of group two totally differs from what it was in group one. It turns out that the subjects in group two were still able to answer questions about the second slide shows, but they appeared to have memory impairment toward the first slide shows, which was in the “edit mode”. Specifically, they forget about the negative part and emotions while still having memories about the second slide show.

Through the experiment on the 50 individuals, it is shown that the editing memory theory is practical. In certain conditions, rediscussing the slideshow in the case, memory can be recalled and

can be gotten into the “edit mode”. Additionally, it was also proved that administering propofol during the edit mode can effectively erase the negative emotions and memory created by the slideshow. However, since the experiment is 24 hours based, there is still a space of uncertainties about whether the theory will still work in a longer term. To answer this question, further investigations and experiments have to be conducted.

As now knowing how editing memory works and that it does have an effect, a problem comes out: Is editing memory ethical? To answer this question, the concept of declarative and nondeclarative memories mentioned in the previous paragraph have to be recalled. Understanding that declarative memory includes while nondeclarative memory is more related to skills and emotional response, the whole memory about the slide shows in the experiment can be categorized. The memory of “facts” about the slide show is declarative memory, on the other hand, the negative emotion created is nondeclarative memory. As for the ethical concerns, people who oppose editing memory are worried about losing values and decisions. Since people learn lessons from the mistake, and try to avoid the same tragedy from the negative memory. Opponents are concerned that memory being edited will also erase personal belief, and will make individuals forget the lesson they learned from the past. For that identity and self-awareness of individuals are built by the past experiences, both negative and positive, the opponents argue that losing memory can also lead to losing oneself. Therefore, in their opinion, editing memory is unethical to a life since it might affect their identity and their belief system. Now, according to the result of the experiment, rather than forgetting about the slide, the memory impairment only showed in the negative part and emotions. This indicates that even if the memory was edited, people will still have a clear picture about what happened, and only the negative emotional connection will be erased. The opponents have concerns that losing memory results in losing self at the same time. However, the experiment proved that the memory won’t get lost, only the emotional response will. Additionally, people learn lessons from reason and consequence, which are the facts and events part of memory. In other words, people learn and improve themselves mainly from declarative memory while editing memory only erases the nondeclarative parts. In this case, individuals do not have to suffer the pains but still can clearly understand the cause and effect of an event to learn a lesson from that memory. Thus, I will say that the ethical problem doesn’t necessarily exist in the case that people still keep the facts about memories. Furthermore, editing memory can become a potential treatment for overcoming trauma as it effectively treats the negative emotions.

Moving on, since I mentioned that a minority of people develop traumatic experiences into PTSD, I would like to also mention propofol being able to learn and memory in PTSD. An experiment was done on this, and it was conducted by Wanqiu Niu, Yanhong Duan, Yu Kang, Xiaohua Cao, and Qingsheng Xue in 2022. A key thing to be noticed is that different from the two experiments I have mentioned, the subject of this experiment was mice. During the experiment, 36 mice were divided into three groups, which are shock plus propofol group, shock plus normal saline group, and sham group (Niu et al., 2022). After treating the three groups, the scientists compare their behavior towards PTSD via observing the mice in various scenario testing, such as sucrose preference test and Morris water maze. Moreover, they examined the hippocampus, which is a part of the brain in charge of memory, by long-term potentiation and long-term depression. Compared to the sham group, the shock plus normal saline group showed increased freezing time and depressive behavior while the shock plus propofol group showed minor changes in the behavior (Niu et al., 2022). The scientist came to the conclusion of propofol being able to speed the fading of fear memories of the PTSD mice. That is, propofol not only acts on negative emotional responses of a trauma but also works on more serious cases like PTSD. Therefore, this experiment further proves that propofol can edit the memory to an extent, and that editing memory is practical in erasing negative emotional responses. Of course, these methods still have to be developed since mice and human brains are similar but are not the same.

In conclusion, I argue that editing memory is a potential treatment to overcome trauma due to the result of the three experiments all supporting the idea that using propofol as a key to edit memory does effectively reduce negative emotion. At the same time, the method doesn’t necessarily have ethical issues since it only treats the emotion part rather than deleting the whole memory. However,

as the experiment was done in 24 hours, the theory has to be developed to see if it also works long term. Additionally, whether it can act the same effectively on PTSD patients needs further research to be confirmed. Still, in my opinion, editing memory can potentially help people overcome trauma.

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