

CASE REPORT

Electrophysiological Evaluation of Disruption in Semantic Memory Induced by Hypnosis: Two Case Reports

Ezgi Tuna Erdoğan, MD, Ece Kocagöncü, Msc, Adnan Kurt,
Önder Uyar, MD, Sacit Karamürsel, MD

Abstract: We reported two cases who were induced to forget number “7” by hypnotic suggestions. While subjects were performing a visual go/no-go task which includes number “7”, their electroencephalogram was recorded. Event related potentials in hypnotic state were compared to waking condition. We observed different results in ERPs between two subjects and then discussed the limits of electrophysiological investigation of the effects of hypnosis on semantic memory (**Sleep and Hypnosis 2013;15(1-2):11-15**)

Key words: Hypnotic amnesia, event related potentials, semantic memory

INTRODUCTION

Hypnotic amnesia is a temporary forgetting induced by hypnotic suggestions. Amnesia can be engendered selective to a specific target in different sensory modalities. There are very few study focusing on hypnotic disruption of semantic memory and no electrophysiological research, to our knowledge. Evans et al. showed that impairment in semantic memory such as subjects’ number system can be obtained by hypnotic suggestions (1). In contrast, there are numerous electrophysiological studies about effects of hypnosis on event related potentials.

Address reprint requests to: Ezgi Tuna Erdoğan, MD,
Istanbul University, Istanbul Faculty of Medicine, Department of
Physiology, Matter and Mind Interactions Laboratory, Fatih, Istanbul
34093 Turkey
Adana Numune Training and Research Hospital, Department of Neurology,
Serinevler Street Ege Bağtur Boulevard Yüreğir, Adana 01240 Turkey
Phone: +905336434749
E-mail: ezgituna.erdogan@gmail.com

Accepted March 17, 2013

Recent studies showed significant amplitude reductions in event-related potentials (P100, P300) during hypnotic blocking of vision and hypnotic numbness (2,3). However some studies observed opposite results: increased P300 amplitude (4). In this paper we present two cases and three additional unsuccessful hypnotic amnesia trials. We used hypnotic alteration of perception for a selected target number “7” which is used in go/no-go task. In other words we erased a number from subjects’ number system temporarily. EEG was recorded from four subjects during the task before and after hypnotic instructions. Our aim was to evaluate electrophysiological changes in ERPs that arise from altered perception during successful and also unsuccessful forgetting of target number induced by hypnosis. All volunteers provided written informed consent. The study was approved by ethics committee of Istanbul Medical Faculty.

CASE REPORTS

For a higher possibility of successful forgetting we chose two subjects who were hypnotized many times previously by the same physician and same hypnotic instructions. The study had two parts: In the first part, after obtaining informed consent, subjects were prepared for 9 channels EEG recording according to International 10–20 method. We used a go/no-go task consist of a presentation of 150 numbers and 150 letters randomly. Subjects sat on a comfortable armchair in front of the screen during the task and they were instructed to press the right button of the mouse each time they saw a number on the

screen. By providing this alert condition in both states—waking and hypnotic—we exclude the effect of relaxation on hypnosis and ERPs. In the second part of the study, subjects were induced to forget a target number “7” by hypnotic suggestions. Participants were told “You will no longer recognize number “7” any more” and asked to count from 1 to 10 to check if they skip over “7”, as intended. The go/no-go task was repeated in hypnotic state. Video of the experiment and EEG were recorded among all subjects during the task. ERP responses to “letters” “numbers” and “target number 7” were analyzed to evaluate the effect of hypnosis on P100 and P300 potentials.

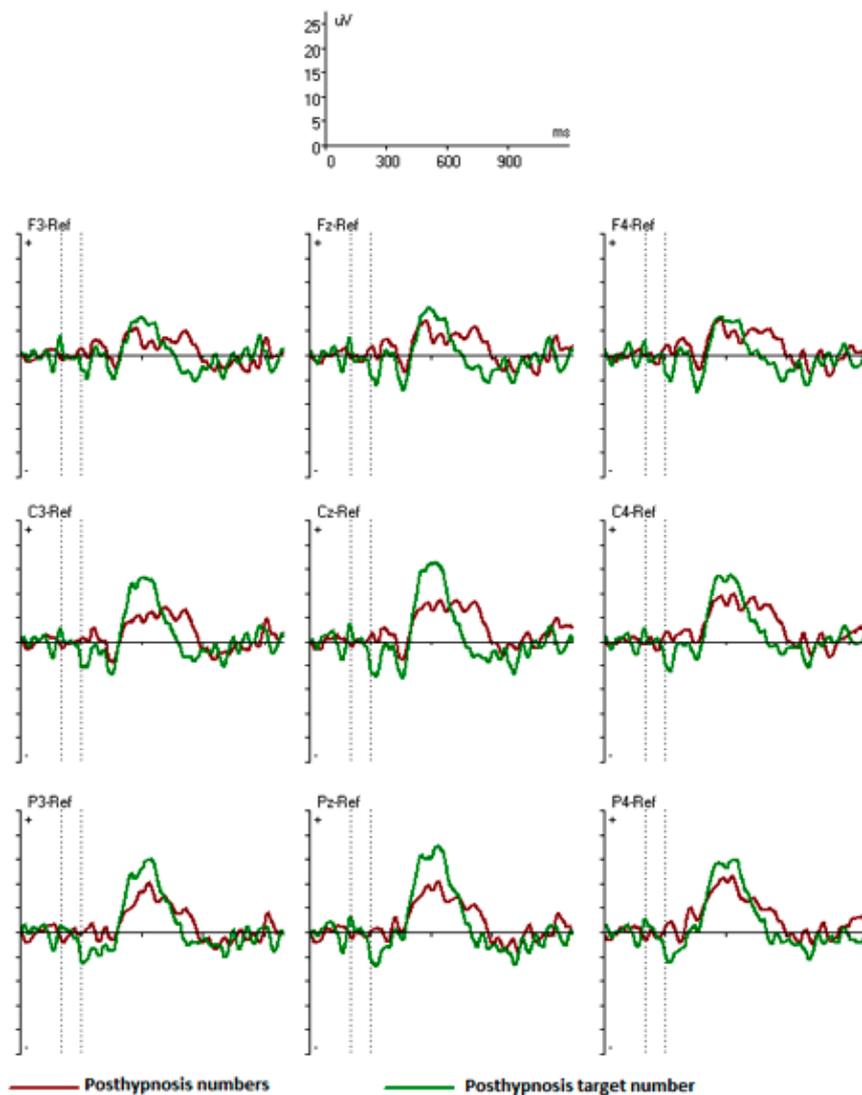


Figure 1. Case 1 ERP responses to numbers and target number “7” in hypnotic state

CASE 1

A 35-year-old male healthy volunteer participated in the study. He forgot the target number “7” after hypnotic suggestions and did not respond to 48 of 50 target stimuli in go/no-go task. No difference was observed between pre and posthypnosis P300 responses to “letters” and “target number 7”. However there was a marked amplitude reduction in P300 responses to “numbers” in hypnotic state (figure 1). We detected a reduction of P100 amplitude to each stimulus type but more prominent in responses to “numbers” in hypnotic state.

CASE 2

A 48-year-old male healthy volunteer participated in the study. He forgot the target number “7” after hypnotic suggestions and did not respond to 48 of 50 target stimuli as in case 1. No difference was observed between pre and post hypnosis responses to “letters”. While there was no difference in P100 amplitude, a tendency to increase in P300 amplitude was observed in post hypnosis responses to both “numbers” and “target number 7” (figure 2).

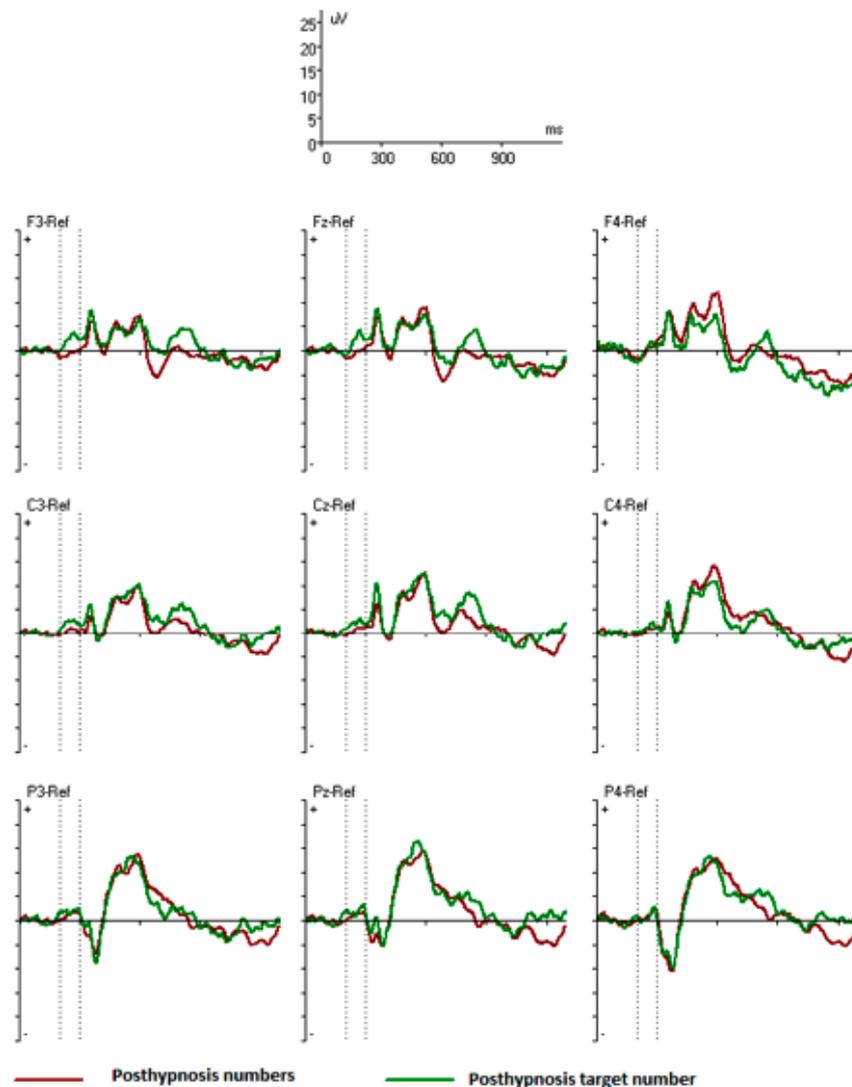


Figure 2. Case 2 ERP responses to numbers and target number “7” in hypnotic state

DISCUSSION

P100 potential is an early component of event related potentials and reflects the process of perception. The late component P300 is a response to perception of a stimuli and reflects information processing influenced by consciousness. It has been reported previously that hypnotic suggestions can reduce the amplitudes of event related sensory potentials (3,5). Two research groups reported that early components in EEG were reduced by inattention during positive obstructive hallucination (6,7). So authors noted that it was not a special process different from inattention during hypnosis. This event does not seem to be possible in our study because we used negative hypnotic instructions for number "7" and subjects were in an alert state during the study because of their mission in the task. Moreover when we look at the button press results to numbers we do not observe any differences in hypnotic state results compared to waking state results which could reflect a possible inattention in the task. Literature had contradictory results in ERP studies until 1988. Spiegel and Barabazs related these findings to a surprise effect first time in 1988 (8). They theorized that if hypnosis is not perfect enough to alter the perception, subject will be surprised by stimulus which increases the P300 amplitude. Spiegel noted that the structure of hypnotic instruction was crucial in this effect (9). In another research, Barabazs compared two different hypnotic instructions on high hypnotizable subjects: 1-Negative obliterating hallucination 2-Positive obstructive hallucination. In the case of negative obliterating hallucination subjects were told that "You are in a dark nebula, you can see nothing at all". In the case of positive obliterating hallucination subjects were told that "Imagine a cardboard box blocking the view of the screen". They found that if negative obliterating hallucination does not work completely, it is hard to stay with the paradigm and causes a surprise when subject see the stimulus which he does not expect. But positive obstructive

hallucination need not to be perfect because incomplete diminished perception also allows to stay in paradigm and still focus on the obstructive box even subject see light through it.

A second crucial issue is hypnotizability. Despite the magnitude of changes in ERPs can be affected by hypnotizability of subjects, both high and low hypnotizable subjects showed a surprise effect when negative obliterating hallucination was used (8). In present study we used hypnotic obstructive suggestions for a number similar to negative obliterating hallucination instructions. Positive obstructive hallucination is not manageable in a go/no-go task therefore by using negative hallucination we could not prevent surprise effect of novelty. We did not test the hypnotizability of subjects before the study but both of them skipped over number "7" while counting in hypnotic state and did not press the button to digit "7" in the task. We video-monitored subjects during the entire study to eliminate the possible blurring or defocusing of subjects' eyes which cause a reduction in ERP amplitudes.

The ERP results of case 1 are compatible with previous reports and decrease in P100 and P300 amplitude suggested that hypnosis successfully reduced his perception of stimuli to numbers. On the other hand ERP responses to target number "7" did not decrease similar to responses to "letters". This result is bringing two ideas. One of them is that subject perceived "target number" as a "letter" in hypnotic state both stimuli were not relevant with the mission of the task (subject was instructed to press the button to only "numbers"). The other possibility is an incomplete hypnosis which led to a surprise effect, interfered with the probable amplitude reduction to number "7". In case 2 there was no reduction in ERP amplitudes and P300 amplitudes had a tendency to increase. These results support an incomplete altering in perception. It may arise from low hypnotizability of subject or from structure of hypnotic suggestion which cause an incomplete hypnosis.

Three healthy volunteers were also enrolled the study who had never been hypnotized before. They were induced by same hypnotic instructions and same physician as two other subjects. In this group, nobody forgot the “target number 7” and they all pressed the button to the target number in the task. We did not observe any change in the ERP data under hypnotic condition compared to awake condition. This additional experiment showed that hypnotic suggestions cause no change in electrophysiological recordings if it is not enough to make forget the target number to subjects

We can draw an electrophysiological conclusion that suggestions were not perfect

enough to discriminate target number “7” from other numbers and to avoid a surprise effect in ERPs. But in behavioral results there was not any difference between subjects. When we compared the results of two cases with three unsuccessful hypnosis trials who were told same hypnotic suggestions, there is a distinct difference in ERP data. In conclusion we showed that hypnosis causes electrophysiological changes during transient amnesia in a semantic memory task. However specific wording of instructions and also individual differences are considered as crucial and challenging factors for electrophysiological studies of hypnotic amnesia.

REFERENCES

1. Evans FJ. *Posthypnotic amnesia and the temporary disruption of retrieval processes. Paper presented at the annual meeting of the American Psychological Association, Honolulu, Hawaii, September 1972.*
2. Spiegel D, Cutcomb S, Ren C. et al: *Hypnotic hallucination alters evoked potentials. J Abnormal Psychology 1985;94:249-255.*
3. Spiegel D, Bierre P, Rootenberg J. *Hypnotic alteration of somatosensory perception. J. Am J Psychiatry 1989; Jun;146(6):749-54.*
4. Barabasz A, Lonsdale C. *Effects of hypnosis on P300 olfactory-evoked potential amplitudes. J Abnormal Psychology 1983;92:520-523.*
5. De Pascalis V. *Event-related potentials during hypnotic hallucination, International J. Clinical and Experimental Hypnosis 1994;42:39-55.*
6. Jasiukaitis P, Nouriani B, Spiegel D. *Left hemisphere superiority for event-related potential effects of hypnotic obstruction. Neuropsychologia 1996;34(7):661-669.*
7. Ray WJ, De Pascalis V. *Temporal Aspects of Hypnotic Processes, International Journal of Clinical and Experimental Hypnosis 2003;51:2,147-165.*
8. Spiegel D, Barabasz A. *Effects of hypnotic instructions on P300 event-related potential amplitudes: Research and clinical implications. American Journal of Clinical Hypnosis 1988;31:11-17.*
9. Spiegel D. *Negative and Positive Visual Hypnotic Hallucinations: Attending Inside and Out, International Journal of Clinical and Experimental Hypnosis 2003;51:2,130-146.*