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# VIRTUAL REALITY HYPNOSIS: *A Case Report*[1]

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**Abstract:** This preliminary case report explored the use of hypnosis induced through a 3-dimensional, immersive, computer-generated virtual reality (VR) world as a means to control pain and anxiety in a patient with a severe burn injury. On hospitalization Day 40, after reports of uncontrollable pain and anxiety, the patient underwent hypnotic induction while immersed in a virtual world and received posthypnotic suggestions for decreased pain and anxiety during subsequent wound-care sessions. The patient's pain and anxiety each dropped 40% after VR hypnosis on a Graphic Rating Scale for his Day 41 wound care. Pain dropped similar levels on Day 42 with an audio-only version of the intervention and then returned to baseline without intervention on Day 43.

Clinical hypnosis would likely reach far greater numbers of patients if interventions did not require the presence of a trained hypnotist. A number of investigators have reported using audiotapes to provide patients with a clinical hypnotic intervention (Block, Ghoneim, Sum Ping, & Ali, 1991; Eberhart, Doring, Holzrichter, Roscher, & Seeling, 1998; Enqvist & Fischer, 1997; Hart, 1980; Johnson & Wiese, 1979; Perugini et al., 1998). Results of these clinical reports have been mixed. Forbes, MacAuley, and Chiotakakou-Faliakou (2000) found that for irritable bowel patients symptom scores improved in 76% of patients hypnotized by a clinician and in 59% of audio-taped patients. They concluded that audio-induced hypnosis could be valuable and cost-effective, though it appears to be less effective than live hypnotherapy. Ghoneim, Block, Sarasin, Davis, and Marchman (2000) used tape-recorded hypnosis on patients before third-molar surgery. Anxiety

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was reduced (compared to a no-treatment control group), but inexplicably there was an increase in the incidence of vomiting for the audio hypnosis group. Blankfield, Zyzanski, Flocke, Alemagno, and Scheurman (1995) randomly assigned patients to listen to either audio hypnotic-suggestion tapes, music tapes, or no treatment intraoperatively and postoperatively. They found no significant differences between groups in length of stay in intensive care, postoperative hospital stay, narcotic usage, nurse ratings of anxiety, progress, depression, activities of daily living, or cardiac symptoms.

In a recent meta-analysis, Montgomery, DuHamel, and Redd (2000) reported analgesic effects in the majority of studies that employed hypnosis for clinical and experimental pain, and Patterson and Jensen (2003) reported that evidence from the available controlled studies indicates that hypnosis is effective with both clinical acute and chronic pain. In spite of all the overall strong findings, it is clear that not every patient benefits from hypnotic analgesia, and it will be valuable to reach greater numbers of patients, particularly those with low hypnotizability scores (Holroyd, 1996). A logical step in increasing the impact of hypnosis is to make hypnotic induction less effortful for the patients. Self-generating the scenarios used in an induction and imagining the objects cued by the hypnotist require considerable concentration for most patients. Patients in pain and/or on medication may not always be willing or able to exert that much cognitive effort. The use of computer-generated stimuli to capture and guide the patient's attention might be one way to make an induction less effortful.

To date, there have been few attempts to apply computer-aided hypnosis to clinical situations. Grant and Nash (1995) used computer-assisted hypnosis as a behavioral measure for assessing hypnosis. Their technology used digitized speech processing coupled with interactive involvement of the hypnotized subject. A digitized voice guided subjects through the procedure at a pace comfortable for the person, and software tailored the procedure according to the subject's unique responses and reactions. Grant and Nash were the first to illustrate the potential of using computers as a new medium for hypnosis.

The present case report expanded on the notion of computerized hypnosis by using immersive virtual reality (VR) as a new medium. Immersive virtual reality is a technology that isolates subjects from the outside world, as well as any threatening stimuli associated with health care. Users have the illusion of going inside the three-dimensional computer-generated environment; a sensation known as ''presence.'' This quality makes immersive VR particularly effective in capturing participants' attention. The attention-grabbing quality of VR environments has already been effective in reducing pain in a number of clinical studies using VR for pain distraction with no hypnosis (Hoffman, Doctor, Patterson, Carrougher, & Furness, 2000; Hoffman,

Patterson, & Carrougher, 2000; Hoffman, Patterson, Carrougher, Nakamura, et al., 2001; Hoffman, Patterson, Carrougher, & Sharar, 2001). Our hope was that putting subjects into a virtual reality might help increase their receptivity to hypnotic suggestion for relaxation and analgesia.

This manuscript reports the first use of VR-induced hypnosis in a clinical situation. The patient enthusiastically agreed to allow us to try hypnosis that was presented through a VR medium as a means to control his symptoms. Prior to undergoing hypnosis, the patient was experiencing excruciating pain and extreme anxiety throughout the day, particularly during times when he had his burn wounds cleaned and debrided.

## Development of VR Hypnosis

The overarching concept in developing VR hypnosis was to use three-dimensional, immersive VR technology to guide the patient through the same steps that are used when hypnosis is induced through an interpersonal process. A typical clinician-to-patient hypnotic induction involves (a) establishing rapport and setting the stage, (b) enhancing relaxation through slowing down breathing, (c) suggestions for deepening the hypnotic state, (d) providing posthypnotic suggestions for subsequent analgesia, and (e) alerting. In conventional hypnosis, subjects undergo these steps through a process that relies on self-absorption and imagination. Inducing hypnosis with VR provided these same elements, yet VR replaced many of the stimuli that the patients have to effortfully imagine via verbal cueing from the therapist.

### *Case History*

The patient was a 37-year-old male who had been admitted into a major regional burn center. He had no psychiatric history and was otherwise healthy. The patient was burned while pouring gasoline into a barbecue pit that he was not aware had embers from a previous fire. The resulting burns covered 55% of the patient's total body surface area (TBSA) involving full thickness burns to bilateral arms, thighs, and hands. He also suffered from smoke inhalation injuries.

Ten days after admission to the intensive care burn unit of the hospital, the patient underwent the first of six surgeries to the right hand, right lower arm, and right lower leg. Much of his wounds were covered with artificial skin, which later was removed and replaced with skin grafts. Between surgeries, the patient underwent once- or twice-daily wound care without general anesthesia during which necrotic skin was removed.

Upon admission to the hospital, the patient was heavily medicated and minimally responsive most of the time. As the patient

demonstrated increased awareness, he developed delirium and anxiety attacks. The hospital staff reported that anxiety and pain were serious problems for this patient, who appeared to have panic attacks in anticipation of his wound-care sessions. The staff were aggressively treating his pain with opioid analgesics and requested psychological adjunctive pain control. On the day before intervention, the patient received 3000 μ of intravenous fentanyl for wound care (an opioid equivalence [OE] of 30.0), a dose approximately three times higher than doses typically given in the Burn Intensive Care Unit (ICU) and more than 15 times higher than the typical opioid dose given during wound care in the Harborview Burn Unit (see Methods Section). Despite these unusually high opioid analgesic dosages, he still reported having excruciating pain. He received a hypnotic induction in VR the next day, the details of which are described below under Procedure.

*Procedure*

On postburn Day 40 (baseline day), the research assistant approached the patient about participating in the study. The study was explained to the patient, his wife, and nurse, and he was given the opportunity to ask questions. The patient-consented to participate. The patient did not receive hypnosis on this day and reported that he had never been hypnotized before. The patient rated how much pain and anxiety he had experienced during his wound-care session that day as a measure of baseline pain. The patient's wound-care sessions required removing gauze and wrappings, scrubbing wounds, debriding necrotic skin, and then rewrapping the wound site.

On treatment Day 1, the patient received a hypnotic induction while drifting through a three-dimensional computer-generated virtual world called SnowWorld. He received the induction at 9 a.m. before a wound-care session scheduled for noon, thus the intervention relied on posthypnotic suggestions. In SnowWorld, participants begin at the top of an icy canyon and float to the bottom as the program progresses. In the pain-distraction version of SnowWorld (Hoffman, Patterson, Carrougher, & Sharar, 2001), patients are able to interact with the virtual environment by shooting snowballs at targets while listening to music during wound care. In the version of SnowWorld used in the present study, the patient went into VR prior to wound care but not during wound care. The patient was not allowed to shoot snowballs or otherwise interact with the environment. Using a Kaiser ProView™ XL50 VR helmet (www.keo.com) and Polhemus Fastrak® head-tracking device (www.Polhemus.com), the patient could look around in SnowWorld by moving his head. The program began with the patient hovering at the top of the canyon while an audiotape of the senior author's voice prepared him for what he would experience during the virtual hypnosis. After four minutes of instruction, the

patient began a 4-minute descent into the snowy 3-D canyon. He could see igloos numbered one to ten slowly float by, and he was directed to count the igloos as they passed. He was instructed that he would become more and more deeply relaxed with each igloo that passed. At the 10th igloo, the patient was told he would be in his most relaxed state and would have descended deep into the canyon. At this point, he was instructed to close his eyes and imagine himself in a special place. He then would hear 4 minutes of audio posthypnotic suggestion while he continued imagining himself in this special place. For the posthypnotic suggestion, the patient was told that he would experience relaxation and pain relief during all subsequent wound-care sessions. Suggestions were made that any time nurses did a dressing change or wound care, the patient would feel a deep sense of comfort and relaxation. He would maintain feelings of relaxation through controlled breathing. The final 4-minute alerting segment began with the audio instructing the patient to open his eyes and prepare to ascend back up to the top of the canyon, counting igloos as he ascended. This time, the numbering on the igloos began with ten and decreased to one as the patient returned to the top of the canyon. The patient was told that he would become more awake and refreshed with each igloo that he passed on the way up until he reached complete alertness at the top of the canyon.

Two hours after the intervention, the patient began a wound-care session, which lasted 90 minutes. Immediately after wound care, the research assistant administered questionnaires reflecting pain and anxiety levels during the wound-care session that day.

Hypnosis was administered the second time on Treatment Day 2 using an audiotape-only hypnotic induction. The patient listened to the same 16-minute audiotape that he had heard on Day 1, with the psychologist's voice guiding the patient through the icy canyon and giving suggestions for hypnosis. However, on Day 2, the patient was not provided with the visual input of the virtual world and instead was instructed to imagine himself going into the 3-D canyon. Approximately 1 hour after completing intervention, the patient was taken to the treatment room for wound care. On both days, hypnotic suggestion was provided 1 to 2 hours prior to wound care, and no psychological intervention occurred during wound care. After the patient returned to his room, the research assistant administered the pain and anxiety ratings.

## MEASURES

Using Graphic Rating Scales (GRS; Scott & Huskisson, 1976), the patient rated worst pain, average pain, time spent thinking about pain, and anxiety during wound care. On the same scale, he rated average

pain over the last 24 hours. At 0 mm, the GRS was labeled ''no pain,'' and at 100 mm, the GRS label was ''the worst possible pain.'' The patient was asked to choose a number from 0 to 100 that best represented his pain. The patient was only able to answer one of the pain ratings after a difficult wound-care session on Treatment Day 3.

The Burn Specific Pain Anxiety Scale (BSPAS; Taal & Faber, 1997) is a five-item VAS that identifies anxiety associated with burn pain. The low end of the 100-mm scale is labeled, ''0-*not at all*,'' and the high end is labeled, ''100-*the worst imaginable way*.'' The scales were as follows:

''I find it impossible to relax when my burns are being treated.''
''I feel my muscles getting tense when the treatment actually begins.''
''I am frightened of the pain during and/or after the treatment.''
''The pain makes me nervous and restless.''
''I find myself worrying about the possible pain I might have to endure for every medical operation.''

*Outcome Data*

The patient's responses on the above measures are shown in Table 1. Relative to preintervention baseline, the patient's subjective GRS pain ratings dropped 40% after VR hypnosis and 60% after audio-alone hypnosis the next day. Compared to preintervention baseline, anxiety scores dropped approximately 50% after VR hypnosis and 60% after audio-alone hypnosis the next day.

*Medication Usage*

All opioid medications given to the patient were recorded and converted into an OE for purposes of comparison. The OE uses morphine as the standard where 10 mg of morphine is equal to 1 OE and 100 μ fentanyl dispensed intravenously. Patients in the ICU are given opioids for pain relief during wound care and for background pain or as needed (PRN) throughout the day.

Over the course of the intervention, opioid use during wound care markedly decreased (see Figure 1). For the baseline data gathered, the day before intervention the patient was administered a wound care OE of 30.00, and total opioid use for baseline (before intervention) was 37.33 OE. Those numbers decreased postintervention on Day 1 (using VR hypnosis) to an opioid use of 23.00 OE during wound care and an opioid total of 28.83 OE for the day. The nurse further decreased the opioids during wound care for postintervention Day 2 (audio hypnosis) to 17.5 OE, because the patient was comfortable with the previous day's reduction. The total opioid use for Day 2 was 23.66 OE. On Day 3, with no intervention, the patient received 20.00 OE during wound care and a total of 26.66 OE.

Table 1
*Pain and Anxiety Scores Throughout Study Period*

| Worst Pain | Baseline (No Treatment) | Day 1 (VR Hypnosis) | Day 2 (Audio Hypnosis) | Day 3 (No Treatment) |
|---|---|---|---|---|
| Worst pain | 100 | 60 | 40 | 100 |
| Average pain | 75 | 45 | 40 | – |
| Average pain over last 24 hours | 60 | 50 | 40 | – |
| Time spent thinking about pain | – | 50 | 30 | 80 |
| Anxiety | 100 | 50 | 40 | – |
| ''Impossible to relax'' | 100 | 54 | 54 | – |
| ''Muscles getting tense'' | 99 | 80 | 71 | – |
| ''Frightened of the pain'' | 100 | 35 | 34 | – |
| ''Nervous and restless'' | 100 | 61 | 39 | – |
| ''Worried about future pain'' | 100 | 60 | 100 | – |

*Note.* Dashes indicate that data was not collected on Day 4. Patient was physically unable to complete questionnaires.

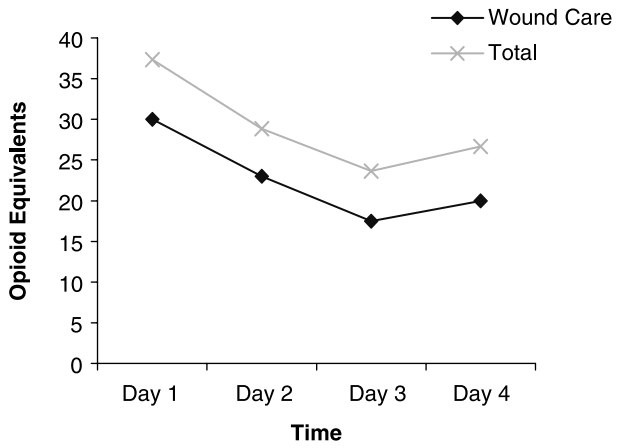


***Figure 1.*** **Patient opioid use during study period.**

*Hypnotizability*

The patient's absorption and hypnotizability were assessed with two separate scales administered on Day 4 by a trained research assistant. On the first measure, the Tellegen Absorption Scale (Tellegen & Atkinson, 1974), the patient scored 18 on a 34-item scale, indicating a moderate absorption score. The patient scored a three out of a possible of five points on the Stanford Hypnotic Clinical Scale (Morgan & Hilgard, 1978–1979), which also indicates medium hypnotizability.

## DISCUSSION

This is the first published report of hypnosis administered through a computer-generated, immersive VR medium. The patient's subjective ratings of pain intensity during wound care indicated a 40% drop in worst pain and a 60% drop in average pain levels. Anxiety scores dropped 50% after the VR hypnosis intervention. Additional drops in pain and anxiety occurred after an audiotape induction the following day. There are several compelling elements to the VR hypnotic induction used. Patients are able to keep their eyes open during the induction phase and are subjected to a captivating environment. This type of medium may be particularly attractive to patients who are struggling with imaginative absorption. It also has great promise for hearing-impaired patients (Repka & Nash, 1995), because written suggestions could be incorporated into this paradigm. With refinement, VR hypnotic environments will likely have useful clinical applications.

It was somewhat surprising that the patient's pain ratings and medication usage returned almost to a preintervention baseline level on Day 3, when he did not receive any type of intervention. Previous research has demonstrated that the analgesic effects of 1 or 2 days of hypnosis continue to be effective for subsequent wound care (Ohrbach, Patterson, Carrougher, & Gibran, 1998; Patterson, Everett, Burns, & Marvin, 1992; Patterson & Ptacek, 1997). This particular patient was in the intensive care unit where it is common for patients to show poor recall secondary to environmental, physiological, and medication effects (Patterson et al.). Although we are unable to substantiate this empirically, it appeared that the patient showed recall for posthypnotic suggestions given 1 to 2 hours prior to his wound care but that his carryover was poor for 24 hours later. In addition, his mental status had declined enough on Day 3 so that he was not able to fill out most of the follow-up data requested, much less comply with posthypnotic suggestions. When working with a patient in the intensive care unit with the accompanying changes in sensorium, hypnotic interventions may have to be repeated on a daily basis until the patient's cognition sufficiently clears.

There are several limitations to this case report. There is no evidence from this study that effects from VR are superior to that created by an audiotape of suggestions. However, we have long excluded audiotapes in the treatment of burn pain, as our clinical impression has been that such interventions are not powerful enough to have an impact on burn pain. Often, the Burn Unit environment competes with the concentration necessary for audiotape inductions. Additionally, this patient reported a strong preference for the VR environment, as opposed to the audiotape. Pain and anxiety scores decreased further after the audiotape, which may suggest that audio-alone tapes facilitated the effects of VR hypnosis rather than being superior to it. The study would have benefited by including more days of follow-up data after the intervention. Because of the patient's burn complications, data were only collected for 1 day of preintervention baseline data and 2 days of intervention, followed by 1 day of no intervention. This report involves a preliminary case study and the substantial limitations of this methodology (e.g., historical confounds; control for placebo effects) are well known (Campbell & Stanley, 1963). A time-series design would have been more effective in accounting for the day-to-day variance that occurs with burn pain and other such phenomena (Borckardt & Nash, 2002). Although our methodology may have served as a vehicle for presenting an innovative technique, definitive evidence for effectiveness will require converging results from larger, more generalizable, controlled studies. Despite the aforementioned limitations, the magnitude of the drops in pain experienced by this patient is encouraging, as were his subjective positive reports about the immersive VR environment.

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## Virtual Reality-Hypnose: Ein Fallbericht

**David R. Patterson, Jennifer R. Tininenko, und Anne E. Schmidt**

**Zusammenfassung: Dieser vorläufige Fallbericht untersucht die Einsatzmöglichkeit von Hypnose, die durch eine dreidimensionale, immersive, computer-generierte virtual-reality-Welt (VR) als Mittel zur Kontrolle von Schmerz und Angst bei einem Patienten mit schweren Brandverletzungen. Am vierzigsten Tag des Krankenhausaufenthalts erlebte der Patient, nach Berichten über unkontrollierbare Schmerzen und Angst, eine Hypnoseinduktion, während er in eine virtuelle Welt eingebunden war. Er erhielt posthypnotische Suggestionen für verminderte Schmerzen und Angst während der folgenden, der Wundversorgung dienenden, Sitzungen. Nach VR-Hypnose fielen Schmerz und Angst des Patienten bei der Wundversorgung am 41. Tag um jeweils 40% auf einer graphischen Bewertungsskala. Der Schmerz fiel in vergleichbarem Ausmaß am 42. Tag unter Verwendung einer reinen Audio-Version der Intervention und erreichte wieder den Ausgangswert am 43. Tag, als keine Intervention erfolgte.**

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## L'hypnose dans la réalité virtuelle: À propos d'un cas

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**Résumé: Ce rapport préliminaire d'un cas, a exploré l'utilisation de l'hypnose induite par un monde virtuel à trois dimensions, totalement immersive, générée par ordinateur à réalité virtuelle (VR) servant à déclencher douleur et**

**inquiétude à un patient présentant des lésions de brŭlure graves. Au 40 ème jour d'hospitalisation, après des scores de douleur et d'inquiétude incontrŏlables, le patient reçu une induction hypnotique pendant qu'il était immergé dans un monde virtuel ainsi que des suggestions post hypnotiques pour diminuer la douleur et l'inquiétude pendant les périodes de soin des ses blessures suivantes. Sur une échelle d'évaluation graphique, l'anxiété et la douleur du patient ont diminué de 40% après l'hypnose en VR pendant les soins au jour 41. De pareils niveaux furent obtenus au jour 42 par une simple version audio lors de l'intervention puis est restée stable sans intervention au jour 43.**

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## La hipnosis de realidad virtual: Un informe de caso

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**Resumen: Este informe de caso preliminar exploró el uso de hipnosis inducida mediante un mundo de realidad virtual (VR) tridimensional, de inmersión, generado por una computadora, para controlar dolor y ansiedad en un paciente con daño severo de quemadura. En el día 40 de hospitalización, después de informes de ansiedad y dolor incontrolable, el paciente experimentó una inducción hipnótica mientras estaba inmerso en un mundo virtual y recibió sugestiones posthipnóticas para disminuir ansiedad y dolor durante las sesiones subsecuentes de cuidado de herida. El dolor y ansiedad del paciente disminuyeron 40% en una Escala Gráfica de Graduación después de la hipnosis con VR en el día 41 de cuidado de herida. El dolor bajó a niveles similares en el día 42 con una versión de la intervención sólo en audio, y regresó a la línea base en el el día 43, sin la intervención.**

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