Published in final edited form as:
Contemp Hypn. 2009 March ; 26(1): 40–47. doi:10.1002/ch.371.

VIRTUAL REALITY HYPNOSIS

Shelley Wiechman Askay[1], **David R. Patterson**[1], and **Sam R. Sharar, MD**[2]

[1] University of Washington School of Medicine, Department of Rehabilitation Medicine

[2] University of Washington School of Medicine, Department of Anesthesiology

Abstract

Scientific evidence for the viability of hypnosis as a treatment for pain has flourished over the past two decades (Rainville, Duncan, Price, Carrier and Bushnell, 1997; Montgomery, DuHamel and Redd, 2000; Lang and Rosen, 2002; Patterson and Jensen, 2003). However its widespread use has been limited by factors such as the advanced expertise, time and effort required by clinicians to provide hypnosis, and the cognitive effort required by patients to engage in hypnosis.

The theory in developing virtual reality hypnosis was to apply three-dimensional, immersive, virtual reality technology to guide the patient through the same steps used when hypnosis is induced through an interpersonal process. Virtual reality replaces many of the stimuli that the patients have to struggle to imagine via verbal cueing from the therapist. The purpose of this paper is to explore how virtual reality may be useful in delivering hypnosis, and to summarize the scientific literature to date. We will also explore various theoretical and methodological issues that can guide future research.

In spite of the encouraging scientific and clinical findings, hypnosis for analgesia is not universally used in medical centres. One reason for the slow acceptance is the extensive provider training required in order for hypnosis to be an effective pain management modality. Training in hypnosis is not commonly offered in medical schools or even psychology graduate curricula. Another reason is that hypnosis requires far more time and effort to administer than an analgesic pill or injection. Hypnosis requires training, skill and patience to deliver in medical centres that are often fast-paced and highly demanding of clinician time. Finally, the attention and cognitive effort required for hypnosis may be more than patients in an acute care setting, who may be under the influence of opiates and benzodiazepines, are able to impart. It is a challenge to make hypnosis a standard part of care in this environment.

Over the past 25 years, researchers have been investigating ways to make hypnosis more standardized and accessible. There have been a handful of studies that have looked at the efficacy of using audiotapes to provide the hypnotic intervention (Johnson and Wiese, 1979; Hart, 1980; Block, Ghoneim, Sum Ping and Ali, 1991; Enqvist, Bjorklund, Engman and Jakobsson, 1997; Eberhart, Doring, Holzrichter, Roscher and Seeling, 1998; Perugini, Kirsch, Allen, et al., 1998; Forbes, MacAuley, Chiotakakou-Faliakou, 2000; Ghoneim, Block, Sarasin, Davis and Marchman, 2000). These studies have yielded mixed results. Generally, we can conclude that audio-taped hypnosis is more effective than no treatment at all, but less effective than the presence of a live hypnotherapist. Grant and Nash (1995) were the first to use computer-assisted hypnosis as a behavioural measure to assess hypnotizability. They used a digitized voice that guided subjects through a procedure and tailored software according to the subject's unique responses and reactions. However, it utilized conventional two-dimensional screen technology that required patients to focus their attention on a computer screen, making them vulnerable to any type of distraction that might enter the environment.

Address for correspondence: Shelley Wiechman Askay, PhD, Assistant Professor, Dept. of Rehabilitation Medicine, Harborview Medical Centre, 325 Ninth Ave, Box 359740, Seattle, WA 98104, wiechman@u.washington.edu.

Further, the two-dimensional technology did not present compelling visual stimuli for capturing the user's attention.

Keywords

hypnotic analgesia; virtual reality; virtual reality hypnosis

Utility of virtual reality for hypnosis

There is the potential for virtual reality technology to expand the application of hypnosis as an analgesic treatment modality. We have found virtual reality technology to be helpful in several settings, particularly where resources are limited, or there are considerable distractions to patients with an already compromised cognitive capacity. Virtual reality hypnosis could potentially eliminate the need for the physical presence of a clinician at most interventions. With less dependence on the skill of a trained hypnotist, such technology may increase our capacity to reach a greater number of patients who could benefit from hypnotic analgesia. The initial acquisition cost of this technology may be expensive now, but is certain to come down in price with improved electronic technologies. With the move toward telemedicine and providing more services to patients in rural areas and underserved regions, this is an exciting concept to explore. It is important to note that virtual reality hypnosis can never completely replace live hypnosis. For complex clinical problems there will always be the need to individualize hypnotic interventions to identifiable patient characteristics. However, at this point, there are many diverse clinical settings, such as pain control from medical procedures or smoking cessation, that are amenable to the more generic type of hypnosis afforded by virtual reality hypnosis. This technology also holds great promise for those patients with hearing impairments as written suggestions can be incorporated into the programme.

In addition, we argue that virtual reality may enhance hypnotic response in those with low hypnotizability. Hypnotizability was first described by Hilgard as a trait measure that assesses a person's ability to be hypnotized (Hilgard and Hilgard, 1975). As mentioned earlier, assessing a person's hypnotizability is important in these studies. We theorize that virtual reality hypnosis may capture attention in those that have trouble with imagination and absorption. The illusion of going inside the three-dimensional computer generated environment is known as 'presence' (Hoffman, Sharar, Coda et al., 2004). This concept of presence is believed to be the key factor in making immersive virtual reality more effective for pain control than traditional methods of distraction such as video games or watching a TV. The sensation of going into' the virtual world enhances a patient's presence in the environment and draws attention away from the pain. Attentional processes are regarded as central to hypnotic analgesia as well. Attention is a critically important step in a hypnotic induction (Crawford, 1990; Crawford 1994; Crawford, Knebel, Kaplan et al., 1998; Gruzelier, 1998). In fact, differences in hypnotic susceptibility have been linked to the efficiency of the frontal lobe and those who are highly susceptible show a functional dissociation of conflict monitoring and cognitive control processes (Jamieson and Sheehan, 2004; Egner, Jamieson and Gruzelier, 2005). With attentional mechanisms as a common denominator, the attention-captivating qualities of virtual reality and the suggestion inherent in hypnosis, the potential for a synergistic effect between these modalities is significant for several reasons. First, hypnotic suggestion may help an inhibited patient relax and immerse themselves in a virtual world. Further, hypnotic suggestion can be used to deepen a patient's sense of presence in the virtual world. As mentioned above however, the critical question is whether virtual reality plays a role in facilitating hypnotic suggestion. Once a patient's attention has been captured in the virtual environment, we would hope that they are more receptive to suggestion.

Scientific evidence

After success in using virtual reality for distraction, we developed immersive virtual reality hypnosis[1] in which hypnosis could be delivered to patients on a burn unit who were under the influence of opioid analgesics, or in such pain that the cognitive effort required for hypnosis was prohibitive. The virtual reality technology for all of the studies that we will describe is identical. It includes the use of the SnowWorld virtual environment software developed specifically for use with patients with burn injuries. Patients don a special helmet (head-mounted display). In our studies to date, patients were placed in a Kaiser Pro View XL50VR helmet outfitted with a Polhemus Fastrak head-tracking device that allowed patients to visually navigate the Snow World environment merely by moving their head. Patients begin in the virtual world by hovering at the top of a virtual arctic canyon while an audiotape of the clinician's voice prepares them for what they will experience during virtual hypnosis. After 4 minutes of instruction, patients begin a 4-minute gentle descent into the snowy three-dimensional canyon, seeing numbers from one to ten that slowly and sequentially float by. Patients are instructed to count the numbers as they pass. At number 10, patients are told that they will be in their most relaxed state and have descended deep into the canyon. At this point, patients are instructed to close their eyes and imagine themselves in a special place. They then hear 4 minutes of audio posthypnotic suggestions for relaxation and pain relief that are to be incorporated into all subsequent burn wound care sessions. The final 4-minute alerting segment begins with the audio instructing the patient to open their eyes and prepare to ascend back up to the top of the canyon, counting 10 virtual igloos as they ascend. They are told that they will become more awake and refreshed and reach complete alertness at the top of the canyon. It is important to note that patients undergo this procedure in their room, prior to their wound care and not during wound care itself, thus we rely heavily on the posthypnotic suggestions for eventual analgesic effect.

The first case study using virtual reality technology to administer hypnosis was published in 2004 (Patterson, Tininenko, Schmidt and Sharar, 2004). The patient was a 37-year-old male who was admitted to the burn centre with full-thickness burns to 55% of his body, including his arms, legs and hands. During his stay on the intensive care unit, he began to have panic attacks and intense anxiety in anticipation of his twice daily painful wound debridements. He consented to participate in this study and said he had never received any type of hypnosis and had no prior mental health history. He was given the Stanford Hypnotic Clinical Scale and scored 3 out of 5, indicating medium hypnotizability and scored 18 out of 34 on the Tellegen Absorption Scale, indicating a moderate ability for absorption. A series of 10-point Graphic Rating Scales (Scott and Huskisson, 1976) were used to determine the worst pain experienced, the average pain experienced, and the time spent thinking about pain. The Burn Specific Anxiety Scale was used to measure anxiety. Baseline measures were taken on Day 1 of the study (no hypnosis). On Day 2 of the study, the patient received virtual reality hypnosis two hours prior to the wound care. The intervention relied on the posthypnotic suggestions given for pain control during wound care, rather than doing the intervention during the actual wound care. On Day 3, the patient listened to an audiotape-only hypnotic induction based on the audio of the virtual reality intervention heard the day before. He was simply told to imagine himself going into the virtual world as he was guided through the hypnotic induction. The effects of the intervention for this patient were encouraging. He reported a 40% reduction in pain ratings from baseline to Day 2 and another 60% reduction in pain after the audiotape alone on Day 3. He also showed a 50% reduction in anxiety from Baseline to Day 2 and a 60% reduction after Day 3. He also reported a positive, subjective experience with the virtual reality technology. The results of this initial case study suggested the value of conducting a larger case series.

[1]We first used the term virtual reality hypnosis as public disclosure in two grant submissions in 2000.

Using the same virtual reality technology and a similar study design, we reported results on 13 patients who subsequently received the intervention (Patterson, Wiechman, Jensen and Sharar, 2006). On average, patients in this study scored in the moderate range for absorption and the medium range for hypnotizability. Using similar methodology described in the previous study, they reported an average 20% drop in worst pain scores from baseline to Day 3, a 29% drop in the time that patients spent thinking about their pain, and a 29% drop in anxiety scores. Surprisingly, there was a 50% reduction in the amount of opioids (calculated opioid equivalents) that patients required before, during and immediately after wound care, providing further evidence of the analgesic efficacy of this technique. Since the intervention is done prior to wound care, there was no added time required to complete wound care for patients in the study. More studies on the use of virtual reality hypnosis for acute pain procedures are currently underway that address some of the methodological issues and limitations raised in this case series, including the use of both a control group and randomized treatment allocation.

Given the success of the intervention for acute pain, we also wanted to explore virtual reality hypnosis application to chronic pain problems. We published this case report in the *International Journal of Clinical and Experimental Hypnosis* (Oneal, Patterson, Soltani, Teeley and Jensen, in press). The patient was a 36-year-old female with a 5-year history of a high-level spinal cord injury (C4 tetraplegia) who suffered from bilateral upper extremity neuropathic pain. She described this pain as a constant burning sensation along her shoulders, arms and forearms. She was unable to wear clothes with sleeves or to be outdoors in the heat or wind. The pain interfered with her sleep and quality of life. She had no prior psychiatric history. She had tried numerous pain management treatments over the years that included various medications, physical therapy, massage therapy, meditation, acupuncture and standard hypnosis, all with no relief. For this study, she received 33 sessions of virtual reality hypnosis over a six-month period. The technology was similar to the previous studies described earlier, with some modifications for chronic pain, including posthypnotic suggestion aimed at overall comfort. Between sessions, the patient was encouraged to practise self-hypnosis at home and was given an audiotape of the virtual reality hypnosis induction. Treatment outcome measures again included Graphic Rating Scales of pain intensity, pain unpleasantness and amount of time the patient experienced a reduction or absence of pain between treatment sessions. She was also asked to take a one-month hiatus from virtual reality hypnosis treatment in order to determine the longer term impact of the intervention. The patient's rating of pain intensity and pain unpleasantness declined by an average of 36% and 33% respectively over the course of the treatment. She also reported no pain for an average of 3.86 hours (over the 33 sessions) after treatment and a reduction in pain for 12 hours after treatment. Although the effects of the intervention did not persist over a longer time (one month), the duration of the treatment effects and the relief provided were superior to other methods that she had tried. She also indicated that she persisted with the treatment because even having three hours free of pain was enough relief to improve the quality of her life. The importance of any relief from pain, even temporary, is a goal shared by many who suffer from chronic pain. These results are also promising and indicate the potential viability of the use of virtual reality hypnosis for chronic pain problems.

Conclusions and future directions

The studies mentioned above show the potential for virtual reality hypnosis and indicate that further study is warranted. There is a clear need for randomized controlled trials of virtual reality hypnosis for both acute and chronic pain problems. Without randomized controlled trials, we will not be able to control for conditions in the environment and within patients that can have an impact on results, particularly when the intervention is conducted in clinical settings. Second, the importance of an audio-only control group to establish the efficacy of virtual reality technology over standard hypnosis, or simply attention from a therapist, is apparent. The treatment effect sizes in the studies we have discussed above are equivalent to

what has been achieved in studies that used a clinician to deliver hypnosis. Further, the effect sizes with standard hypnosis do not seem to rival those achieved with virtual reality hypnosis. However, it is important that virtual reality hypnosis be compared to audio-only hypnosis in a controlled trial. The technology used in virtual reality hypnosis is far more expensive than that of a simple audiotape, and distinct advantages of virtual reality hypnosis would have to be demonstrated in a direct comparison, in order to establish a rationale for the increased equipment costs.

One advantage of virtual reality hypnosis is that it is completely standardized and does not depend upon the skill or availability of a trained therapist. This standardization is appealing in conducting more research and understanding more fully the underlying physiological mechanisms involved in hypnosis. In many studies of clinical hypnosis, even if the exact same wording is used, the clinician that delivers the hypnosis is subject to substantial variability. With virtual reality hypnosis, this issue of consistency is no longer subject to question.

The role of hypnotizability and the impact of clinical (as well as laboratory) effects of hypnosis are important variables in any experimental study of this type. With virtual reality hypnosis, there have been some efforts to assess user hypnotizability. Unfortunately this has been measured with the Stanford Clinical Scale of Hypnotizability (SCHS), which is only a 5-item scale. The SCHS lacks the range and psychometric properties of superior scales such as the Stanford A or C (Weitzenhoffer and Hilgard, 1959; Weitzenhoffer and Hilgard, 1962). As such, the role of hypnotizability and response in virtual reality hypnosis is not fully understood. In our studies, as is the case in most others, the majority of participants score in the medium range of hypnotizability. Future studies with larger subject numbers may want to separate out those with high vs. low hypnotizability scores in their analyses to see if there is a differential analgesic effect in these two patient populations.

Finally, the critical question remains as to whether patients with low hypnotizability scores may actually do better in virtual reality hypnosis. Imaginative absorption is a variable reported to be important to hypnotic response (Tellegen, 1979). If subjects have compelling visual and auditory stimuli presented for them (e.g. virtual reality), then they have to rely less on their own imagination. Thus, subjects theoretically need less imaginative absorption to benefit from virtual reality hypnosis. However, it is unclear if this hypnotic advantage translates into improved suggestion for analgesia. We would hope that patients with low hypnotizability will show more attention to virtual reality hypnosis, but we have yet to determine if this translates into an enhanced analgesic response to suggestion.

We have only scratched the surface in exploring the potential application of this modality both in the laboratory and in the clinical situation. What can be offered now with respect to virtual reality hypnosis technology is only an early prototype. There are countless variables to be investigated, such as the nature of the virtual environment, the role of auditory stimulation, the ideal duration of treatment, and whether or not patients should have their eyes closed and rely on imagination for some of the time in virtual reality or keep their eyes open the entire time. We doubt that we can ever provide computer-generated stimuli that are more compelling than human imagination. Ultimately, the optimal use of virtual reality hypnosis may be in the form of an interaction between patients and technology. Some patients may generally prefer imagination while others may show a proclivity to passively experiencing computer generated stimuli, especially in situations where cognitive functioning is compromised and the need for cognitive effort is minimized. These are all questions yet to be explored. With society's increasing reliance on technology, however, the application of virtual reality to a spectrum of medical issues, including pain relief, is an exciting prospect that could potentially benefit millions of people.

Acknowledgments

This paper was supported by funding from the NIH (1R01AR054115-01A1) as well as the National Institute on Disability and Rehabilitation Research in the Office of Special Education and Rehabilitative Services in the U.S. Department of Education.

References

Block RI, Ghoneim MM, Sum Ping ST, Ali MA. Efficacy of therapeutic suggestions for improved postoperative recovery presented during general anesthesia. Anesthesiology 1991;75(5):746–55. [PubMed: 1952199]

Crawford, HJ. Cognitive and psychophysiological correlates of hypnotic responsiveness and hypnosis. In: Mass, ML.; Brown, D., editors. Creative Mastery in Hypnosis and Hypnoanalysis: A Festschrift for Erika Fromm. Hillsdale, NJ: Lawrence Erlbaum; 1990. p. 47-54.

Crawford HJ. Brain dynamics and hypnosis: attentional and disattentional processes. International Journal of Clinical and Experimental Hypnosis 1994;42(3):204–32. [PubMed: 8063461]

Crawford HJ, Knebel T, Kaplan L, et al. Hypnotic analgesia: 1. Somatosensory event-related potential changes to noxious stimuli and 2. Transfer learning to reduce chronic low back pain. International Journal of Clinical and Experimental Hypnosis 1998;46(1):92–132. [PubMed: 9439105]

Eberhart LH, Doring HJ, Holzrichter P, Roscher R, Seeling W. Therapeutic suggestions given during neurolept-anaesthesia decrease post-operative nausea and vomiting. European Journal of Anaesthesiology 1998;15(4):446–52. [PubMed: 9699102]

Egner T, Jamieson G, Gruzelier J. Hypnosis decouples cognitive control from conflict monitoring processes of the frontal lobe. Neuroimage 2005;27(4):969–78. [PubMed: 15964211]

Enqvist B, Bjorklund C, Engman M, Jakobsson J. Preoperative hypnosis reduces postoperative vomiting after surgery of the breasts. A prospective, randomized and blinded study. Acta Anaesthesiologica Scandinavica 1997;41(8):1028–32. [PubMed: 9311402]

Forbes A, MacAuley S, Chiotakakou-Faliakou E. Hypnotherapy and therapeutic audiotape: effective in previously unsuccessfully treated irritable bowel syndrome? International Journal of Colorectal Disease 2000;15(5–6):328–34. [PubMed: 11151439]

Ghoneim MM, Block RI, Sarasin DS, Davis CS, Marchman JN. Tape-recorded hypnosis instructions as adjuvant in the care of patients scheduled for third molar surgery. Anesthesia and Analgesia 2000;90 (1):64–8. [PubMed: 10624980]

Grant CD, Nash MR. The computer-assisted hypnosis scale: standardization and norming of a computer-administered measure of hypnotic ability. Psychological Assessment 1995;7:49–58.

Gruzelier J. A working model of the the neurophysiology of hypnosis: a review of the evidence. Contemporary Hypnosis 1998;15(1):3–21.

Hart RR. The influence of a taped hypnotic induction treatment procedure on the recovery of surgery patients. International Journal of Clinical and Experimental Hypnosis 1980;28(4):324–32. [PubMed: 7409927]

Hilgard, ER.; Hilgard, JR. Hypnosis in the Relief of Pain. Los Altos, CA: William Kaufmann, Inc; 1975.

Hoffman H, Sharar S, Coda B, et al. Manipulating presence influences the magnitude of virtual reality analgesia. Pain 2004;111(1–2):162–8. [PubMed: 15327820]

Jamieson GA, Sheehan PW. An empirical test of Woody and Bowers's dissociated-control theory of hypnosis. International Journal of Clinical and Experimental Hypnosis 2004;52(3):232–49. [PubMed: 15370356]

Johnson LS, Wiese KF. Live versus tape-recorded assessments of hypnotic responsiveness in pain-control patients. The International Journal of Clinical and Experimental Hypnosis 1979;27(2):74–84. [PubMed: 161556]

Lang E, Rosen M. Cost analysis of adjunct hypnosis with sedation during outpatient radiologic procedures. Radiology 2002;222:375–82. [PubMed: 11818602]

Montgomery GH, DuHamel KN, Redd WH. A meta-analysis of hypnotically induced analgesia: how effective is hypnosis? International Journal of Clinical and Experimental Hypnosis 2000;48(2):138–53. [PubMed: 10769981]

Oneal BJ, Patterson DR, Soltani M, Teeley A, Jensen MP. Virtual reality hypnosis in the treatment of chronic neuropathic pain: a case report. International Journal of Clinical and Experimental Hypnosis. in press.

Patterson DR, Jensen M. Hypnosis and clinical pain. Psychological Bulletin 2003;129(4):495–521. [PubMed: 12848218]

Patterson DR, Tininenko JR, Schmidt AE, Sharar S. Virtual reality hypnosis: a case report. The International Journal of Clinical and Experimental Hypnosis 2004;52(1):27–38. [PubMed: 14768967]

Patterson DR, Wiechman SA, Jensen M, Sharar SR. Hypnosis delivered through immersive virtual reality for burn pain: a clinical case series. International Journal of Clinical and Experimental Hypnosis 2006;54(2):130–42. [PubMed: 16581687]

Perugini EM, Kirsch I, Allen ST, et al. Surreptitious observation of responses to hypnotically suggested hallucinations: a test of the compliance hypothesis. International Journal of Clinical and Experimental Hypnosis 46(2):191–203.

Rainville P, Duncan GH, Price DD, Carrier B, Bushnell MC. Pain affect encoded in human anterior cingulate but not somatosensory cortex. Science 1997;2(77):968–71. [PubMed: 9252330]

Scott J, Huskisson EC. Graphic representation of pain. Pain 1976;2(2):175–84. [PubMed: 1026900]

Tellegen A. On measures and conceptions of hypnosis. The American Journal of Clinical Hypnosis 1979;21(2 & 3):219–37. [PubMed: 747167]

Weitzenhoffer, AM.; Hilgard, ER. Stanford Hypnotic Susceptibility Scale Forms A & B. Palo Alto, CA: Consulting Psychologists Press; 1959.

Weitzenhoffer, AM.; Hilgard, ER. Stanford Hypnotic Susceptibility Scale, Form C. Palo Alto, CA: Consulting Psychologists Press; 1962.