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Virtual Reality Hypnosis In The Treatment Of Chronic Neuropathic Pain: A Case Report

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Abstract

This case report evaluates virtual reality hypnosis (VRH) in treating chronic neuropathic pain in a patient with a 5-year history of failed treatments. The patient participated in a 6-month trial of VRH, and her pain ratings of intensity and unpleasantness dropped on average 36% and 33%, respectively, over the course of 33 sessions. In addition, she reported both no pain and a reduction of pain for an average of 3.86 and 12.21 hours, respectively, after treatment sessions throughout the course of the VRH treatment. These reductions and the duration of treatment effects following VRH treatment were superior to those following a trial of standard hypnosis (non-VR) treatment. However, the pain reductions with VRH did not persist over long periods of time. The findings support the potential of VRH treatment for helping individuals with refractory chronic pain conditions.

Hypnotic analgesia has become an increasingly important aspect in the treatment of clinical and experimental pain (Lang et al., 2000; Montgomery, DuHamel, & Redd, 2000) and has been used on virtually every type of pain (Patterson & Jensen, 2003). Patterson and Jensen reviewed 29 randomized, controlled studies of hypnotic analgesia and concluded that (a) the evidence supporting the efficacy of hypnotic analgesia is strong, and (b) hypnotizability is usually related to outcome in studies that measure this variable. With respect to the importance of hypnotizability, one potential strategy for increasing the impact of hypnosis is to make hypnotic induction less effortful. We hypothesized that by providing visual stimuli for a patient during hypnosis treatment and giving the patient an illusion of “sinking into a virtual world,” the induction would require less concentration and mental effort from the patient and therefore might be more effective than standard hypnosis. As Patterson, Tininenko, Schmidt, and Sharar (2004) posited, using computer-generated stimuli to capture and to guide the patient's attention may not only make the induction less effortful but also more widely available, given that such a treatment would not require the presence of a clinician trained in hypnosis.

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Although there have been few attempts to apply computer-generated hypnosis to clinical situations, results from a recent study on procedural pain revealed that hypnosis delivered through immersive virtual reality (VR) was very effective in reducing patients' reported pain and anxiety and may have reduced the need for opioid analgesics (Patterson, Wiechman, Jensen, & Sharar, 2006). Immersive VR hypnosis (VRH) isolates patients from the outside world. With VR, patients have the illusion of going inside the three-dimensional computer-generated environment. Because VR is designed to be a highly attention-grabbing experience, it reduces the amount of attention available to process pain and instead maximizes the person's ability to narrowly focus on a hypnotic induction thereby facilitating dissociation of pain. The goal of creating VRH was to develop a three-dimensional, immersive virtual reality technology that could guide the patient through the same steps that are used when hypnosis is induced through an interpersonal process.

While there is a recent interest in using VR as a medium for hypnosis, this application is relatively new and has primarily been applied to acute procedural pain. The purpose of this case study was to expand the use of VRH to the treatment of a patient with chronic neuropathic pain, and, to our knowledge, it is the first research of its kind. In addition, in the present study, we were able to compare the results of the current trial of VRH to the results of a previous trial of standard hypnosis (non-VR) treatment that was conducted with the patient a few years earlier by one of the investigators. We hypothesized that this patient would have a significant reduction in pain and achieve a greater and longer lasting reduction in pain with VRH than standard (non-VR) hypnosis.

Case History

The patient was a 36-year-old female with a 5-year history of C4 tetraplegia and upper extremity neuropathic pain. She had no psychiatric history and was otherwise healthy. Approximately 5 years prior to the initiation of VRH treatment, she was injured as the passenger in a motor vehicle crash and spent close to 4 months in a major regional trauma center. Since that time, she has participated in both inpatient and outpatient rehabilitation and has worked closely with medical staff through a major regional multidisciplinary pain clinic. She described her pain as a constant burning sensation along the lateral aspects of her shoulders, medial arms, and proximal/anterior forearms, which was worse in her left arm. She was unable to wear clothes with sleeves as those garments increased her pain. She was also unable to be outdoors when there was any wind or precipitation due to her pain. In addition, her pain was very sensitive to temperature, and if the temperature was more than a few degrees above or below 73° F, her pain intensified. Finally, she also reported significant sleep difficulties secondary to her pain.

She has tried many treatments for pain management over the years, including multiple medications, physical therapy, massage therapy, acupuncture, Tibetan sound therapy, meditation, and electrical stimulation. Also, as noted above, she participated in a clinical trial of standard (non-VR) self-hypnosis training (Jensen et al., 2005, 2008). She reported that all of those treatments had been relatively unhelpful in the reduction of her pain.

Regarding past medications, this patient has tried over 15 medications to help her with pain management, including oxycodone, methadone, oxcarbazepine (Trileptal), venlafaxine (Effexor), diazepam (Valium), lorazepam (Ativan), pregabalin, mexiletine, and triazolam. She used to meet with her physician through the multidisciplinary pain clinic once every 3 weeks for pain management. However, for the year prior to the time that this study began, she had been meeting with that professional about once every 2 months.

During this study, the patient was taking the following medications: Diazepam 5 mg SID for sleep and pain; oxcarbazepine 300 mg SID for pain; trazodone 100–150 mg SID for sleep; mexiletine 150 mg BID for pain; venlafaxine 150 mg in am/75 mg in pm for pain; and tolterodine (Detrol LA) 4 mg SID for treatment of an overactive bladder.

Procedure

The patient became known to us after she contacted one of the authors with an interest in virtual reality distraction after hearing about this in the media. She was told that virtual reality distraction is not well suited for chronic pain but also that we could provide virtual reality hypnosis to see if this might be of benefit for her. The first two authors met with the patient to explain the study and VRH treatment. She consented to participate. The measures and data collection procedures for this study were very similar to those used in a previous trial of standard hypnosis (Jensen et al., 2005). Baseline and follow-up data was obtained from the patient by telephone interview. In order to determine the longer-term effects of having participated in VRH, the patient was asked to take a hiatus from treatment for a 1-month period. During that time one of the authors contacted her on a weekly basis by telephone to assess her comfort with the treatment hiatus and she was told that at any time during the break, if her pain became too intense, she was welcome to return to VRH sooner than the 1-month timeframe. Session logs were completed with the patient before and after each VRH session. The treatment outcome measures analyzed for this case report included average pain intensity and pain unpleasantness, as well as amount of time (in hours) the patient experienced a reduction or absence of pain between treatment sessions. The patient was also administered the Stanford Hypnotic Clinical Scale (SHCS; Morgan & Hilgard, 1978–1979) in order to assess level of hypnotizability.

The patient participated in a total of 33 VRH treatment sessions over the course of 6-months. All sessions occurred in a private office at a regional trauma medical center in Seattle, Washington. All sessions involved the patient receiving an audio recording of a hypnotic induction, suggestions for pain relief, and then alerting while drifting through a three-dimensional computer-generated virtual world called SnowWorld (See Patterson, Tininenko, Schmidt, & Sharar, 2004; Patterson et al., 2006 for details of SnowWorld). Between sessions, the patient was encouraged to practice self-hypnosis regularly by using the compact disc that was given to her with the audio of the VRH protocol. In other words, she could listen to the audio version of the hypnosis at home, but did not have the visual stimuli available during the at-home practice sessions. She was also asked to complete daily diaries of her pain, unpleasantness, and frequency of home practice throughout the 6-months of treatment. She e-mailed the diaries to the first author of this article.

The VRH program began by having the patient hovering at the top of the snow canyon while an audiotape of the hypnotist's voice prepared the patient for what she would experience during the virtual hypnosis. After approximately 6 minutes of instruction, she began a 6-minute descent in the “snowy” 3-D canyon and she experienced herself as floating by numbers (1 through 10, in order) and was instructed to deepen her relaxation as she passed by each number. At number 10, she was told that she was in her most relaxed state and had descended deep into the canyon. At that point, she experienced herself hovering above the lake and was given about 18 minutes of audio posthypnotic suggestions. That was followed by approximately 10 minutes of alerting as she ascended back up the “snowy” 3-D canyon and floated by numbers (10 through 1, in order).

The Nature of Hypnotic Suggestions

Although the exact transcript of the hypnotic suggestions is too long to report, we will provide examples of the content. First, there was an introduction to the lake. The lake was described

to the patient, and she was encouraged to become increasingly absorbed in the scene and to let her body relax. Then the program addressed her mind and how it could be a tremendous resource to help her feel safe and comfortable. The next section discussed how pain affects her life. An example of this dialogue is, “Part of you knows what it takes to feel more comfortable, to allow you to heal faster. It is there, it's just that it only comes to you, to your awareness, during certain times of your life, and what you realize is that this part of your mind is going to become present in your life during this time of healing, or during the time when you are undergoing pain.” The following segment dealt with asking the patient to imagine a time before the trauma. She was then instructed to recall images from a time in the past when she had positive experiences and to remember how comfortable she felt then.

After she was asked to recall positive images and experiences from her past, she was directed to move forward in time and to continue to see positive images of herself functioning well. She was told that images from the past and from the future should start to have a strong connection. Then the patient was given suggestions for sleeping better through the night, and it was also suggested that any exercises she engages in would become easier. It was recommended that she change the experience of her pain to a sense of coolness or numbness, or even forget about it altogether. She was also guided that as her pain improved she would find the ability to continue doing things that make her feel better, such as increasing her movement and participating more in life. The lake segment concluded by giving the patient a chance to engage in any other experiences or images that she might like to have, or to give herself positive suggestions of her own. She was then provided a period of silence for her to do that. The final suggestion focused on the fact that her comfort would be far greater when she took off the VR helmet than it was before she started the session.

Outcome Measures

The outcome measures analyzed for this study included pre- to posttreatment through 1-month follow-up of average pain intensity and pain unpleasantness. These outcome measures were the two that demonstrated significant effects in the original hypnosis only (non-VR) study that this patient previously participated in (Jensen et al., 2005). Both outcome domains were assessed at each outcome assessment point by contacting the patient four times within a 7-day window, and asking her to rate her usual pain intensity and pain unpleasantness over the past 24 hours on 0 (*no pain; not bad at all*) to 10 (*the most intense pain sensation imaginable; the most intense bad feeling possible for me*) Numerical Rating Scales. The four ratings for each outcome domain were then combined into composite measures of average pain intensity and pain unpleasantness.

In addition, the patient rated pain intensity and unpleasantness before and after each VRH session, using the same 0 to 10 Numerical Rating Scales described. These ratings were averaged into separate composite scores. That is, the pre- and postsession pain intensity and pain unpleasantness ratings were averaged for both the first 10 sessions and also all 33 sessions of VRH. Developing the composite scores from the first 10 sessions of VRH allowed for a direct comparison between VRH and the standard (non-VR) hypnosis trial, which included 10 sessions of treatment. The final outcome measure was the amount of time (in hours) that the patient experienced a reduction or absence of pain between treatment sessions. In the same manner as described above, these ratings were averaged into separate composite scores (VRH-33 sessions, VRH-first 10 sessions, standard hypnosis-10 sessions).

Outcome Data

Relative to the pretreatment baseline, the patient's ratings of average pain intensity and pain unpleasantness were not significantly different from her posttreatment or 1-month follow-up

ratings. This outcome was similar for both the current VRH study as well as the hypnosis (non-VR) study that was conducted in 2004–2005. See Table 1 for the patient's average pain intensity and pain unpleasantness ratings pre/posttreatment as well as at 1-month follow-up for both the VRH and hypnosis (non-VR) treatments. In other words, VRH did not create lasting changes in the patient's pain perception.

However, when investigating pain levels immediately after treatment, the patient's average pain intensity levels and pain unpleasantness ratings from pre- to posttreatment session, there was a 36% reduction in her average pain intensity and a 33% reduction in her average pain unpleasantness from pre- to post-VRH (see Table 2). As explained above, in order to directly compare the VRH and hypnosis (non-VR) ratings, the first 10 sessions of the VRH treatment were compared to the 10 sessions of hypnosis (non-VR) treatment that this patient had previously completed. See Table 2 for a depiction of the VRH 10-session and the hypnosis (non-VR) 10-session ratings. This patient reported an average of 25% pain intensity reduction and 20% pain unpleasantness reduction over the course of the first 10 sessions of VRH, compared to an average of 7% pain intensity reduction and 15% pain unpleasantness reduction over the course of the 10-session hypnosis (non-VR) treatment.

With respect to the duration of pain decrease between treatment sessions, this patient reported an average of 12.21 hours of pain reduction and 3.86 hours of being pain free over the course of the 33 sessions of VRH treatment. For the first 10 sessions of the VRH treatment she reported an average of 8.5 hours of pain reduction and 4.3 hours of being pain free, compared to an average of 1 hour of pain reduction and 0 hours of being pain free over the course of the 10-session hypnosis (non-VR) treatment (See Table 3).

Finally, on the Stanford Hypnotic Clinical Scale (Morgan & Hilgard, 1978–1979), the patient received a score of 2, placing her in the low to low-moderate range of hypnotizability.

Discussion

This report represents our first attempt to apply immersive virtual reality hypnosis to treat chronic neuropathic pain in a woman with a spinal cord injury who had not responded to any form of prior treatment. The patient's subjective ratings of pain intensity and pain unpleasantness showed an immediate reduction that averaged 36% and 33%, respectively, from pre- to post-VRH treatment. In addition, the amount of time that this patient experienced no pain or a reduction of pain over the course of the 33 VRH-treatment sessions averaged 3.86 and 12.21 hours, respectively. Furthermore, when compared to hypnosis alone (non-VR), this patient experienced a greater reduction in pain intensity and pain unpleasantness as well as longer lasting freedom from pain throughout the course of treatment with VRH.

The fact that this patient's pretreatment ratings of pain intensity and pain unpleasantness were not significantly different from her posttreatment and 1-month follow-up ratings of pain intensity and pain unpleasantness suggests that VRH treatment was helpful for her on a time-limited basis, that is, on average, 12.1 hours. The relatively short-lived effect of VRH in this patient's case is consistent with recent research suggesting that although hypnosis may not “cure” a person's chronic pain, it can be an important part of a person's plan to manage chronic pain on a daily basis (Jensen et al., 2008). In other words, hypnosis can provide many patients with a means of coping with pain, much like they might use medications (that also provide only short-term relief), but without the negative side-effects of those medications. In fact, research suggests that hypnosis can provide many beneficial “side effects” (e.g., improved well-being, improved sense of control over pain, improved sleep, etc.) that can contribute to a patient's quality of life over and above its effects on pain (Jensen et al., 2006).

Thus, even though some patients (about between 20%–30%, cf. Jensen et al., 2008) with chronic pain can experience substantial and long-term reductions in average daily pain following hypnosis treatment, many more patients than this report some relief of pain via hypnosis, view it as helpful and continue to use it up to 12 months following treatment. Therefore, although the patient in this case report was not “cured” of her pain, which would have been surprising given the refractory nature of it, she did achieve meaningful benefits through the use of VRH that lasted for many hours. Furthermore, while overall pain measurements did not change substantially, observation of means suggests that the directions of changes were in the direction anticipated. Specifically, overall ratings went down during the treatment period rather than baseline and then increased again during the month with no treatment.

The findings that this patient, who has suffered from severe and chronic neuropathic pain for over 5 years and has tried a myriad of other interventions, including over 15 medication trials, achieved a significant and lasting reduction in her pain throughout the course of VRH treatment is extremely promising. It was interesting that the patient went through the efforts to come to the hospital for months; given her spinal cord injury this was logistically difficult for her. It was also noteworthy that she reported that she benefited more from the induction when it was paired to the visual stimuli, rather than presented simply through audiotape. She also chose to resume treatment after a 1-month no-treatment period requested by the investigators. During one of the final VRH sessions before the treatment hiatus, this patient indicated that over time she was learning how to control her pain better, largely due to the experience that she has received through virtual reality hypnosis.

It was also noteworthy that the patient scored low on a scale measuring hypnotizability. Although the Stanford Hypnotic Clinical Scale is a screening measure, it has been reported to have good correlations with the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C; Bryant, Guthrie, Moulds, Nixon, & Felmingham, 2003). The fact that the patient had a good response to the virtual reality hypnosis with a relatively low hypnotizability score is encouraging to us. Our hope is that this technology will be most useful to patients that do not have a high level of hypnotizability. Specifically, it may be that providing attention-grabbing stimuli that matches the suggestions may help patients become more absorbed in the process when this does not come naturally.

We maintain that this patient's chronic neuropathic pain is a challenging clinical problem with no easy solution. This report is provided after 6-months of treatment, with an empirical hiatus of no treatment. Our hope is that with repeated treatment, the pain relief experienced by the patient will last for greater, and hopefully more extensive, periods of time.

There are several limitations to this case report. As with a study of this design, we are not controlling for historical factors that might have influenced the patient's pain perception; randomized controlled studies are necessary to control such extraneous variables. One of the biggest threats to validity is not knowing if the patient reported pain reductions simply to please the investigators. However, we should note that she was willing to report no reductions in pain over several periods during the study. Further, although historical confounds are always a consideration, it is difficult to argue that the drops in pain that occurred over almost all of the 33 treatments were attributable to anything other than the intervention. The activity required to travel to the hospital was more likely to exacerbate than to reduce pain in itself. Finally, this technology used in the intervention was novel and has not yet been refined for use. In spite of these drawbacks, however, we view the pain reductions that occurred with VRH, especially in light of previous poor response to other treatments, as promising and indicate that additional investigation of virtual reality hypnosis for chronic pain is warranted.

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Table 1
Means and SDs of Average Intensity of Pain and Pain Unpleasantness at Pretreatment, Posttreatment, and 1-Month Follow-Up for VRH and Hypnosis Treatments

Treatment Type	Intensity of Pain			Unpleasantness of Pain		
	Pretreatment Mean (SD)	Posttreatment Mean (SD)	1-month F/Up Mean (SD)	Pretreatment Mean (SD)	Posttreatment Mean (SD)	1-month F/Up Mean (SD)
VRH	7.67 (.58)	7.00 (.91)	7.50 (0)	7.30 (.58)	6.63 (1.25)	7.50 (0)
Hypnosis (non-VR)	7.50 (.96)	7.00 (.82)	9.00 (0)	8.50 (.58)	7.25 (.5)	9.00 (0)

Table 2
Means and SDs of Pre-session to Post-session Intensity of Pain and Unpleasantness of Pain for 33-Sessions of Virtual Reality Hypnosis (VRH33), 10-Sessions of Virtual Reality Hypnosis (VRH10), and 10-Sessions of Hypnosis (Hyp10)

Treatment Type	Intensity of Pain		Unpleasantness of Pain	
	Pre-session Mean (SD)	Post-session Mean (SD)	Pre-session Mean (SD)	Post-session Mean (SD)
VRH33	6.85 (.84)	4.41 (1.46)	7.03 (.82)	4.72 (1.59)
VRH10	7.30 (.82)	5.45 (.93)	7.40 (.70)	5.90 (.88)
Hyp10	6.10 (1.10)	5.70 (1.16)	6.70 (1.49)	5.70 (1.34)

Table 3
Means and SDs of the Duration (in Hours) of No Pain and Reduced Pain Throughout the Course of 33-Sessions of Virtual Reality Hypnosis (VRH33), 10-Sessions of Virtual Reality Hypnosis (VRH10), and 10-Sessions of Hypnosis (Hyp10)

Treatment Type	No Pain Mean (SD)	Reduced Pain Mean (SD)
VRH33	3.86 (8.90)	12.21 (27.06)
VRH10	4.33 (9.65)	8.50 (13.43)
Hyp10	0 (0)	1.00 (0)