

Rewiring the Brain for Less Pain

Use of Innovative VR Software Program Gives Patients Relief at the Providence Cancer Institute



Industry

Healthcare

Objective

Test the efficacy of VR in reducing pain and opioid drug use in cancer patients

Approach

Cancer patients recovering from surgery used virtual reality several times a day. Pain scores were compared against a control group.

IT Matters

- Powerful VR experiences delivered with Intel®-driven HP technology
- Small-footprint VR solution that fits on one ErgoCart
- Flexible: Variety of off-the-shelf VR headsets and controllers can be used with the solution
- Sensors can be attached to monitor patient vitals, provide biofeedback
- Firsthand Technology VR software powered by HP

Business Matters

- Simple setup
- Patients can start using it right away
- Requires little hospital staff assistance
- Initial results indicate reduced pain scores and opioid use
- Previous studies show shorter hospital length of stay



Patients can use the Firsthand/HP/Intel/HTC VR solution from their hospital bed or chair. The technology is integrated on a small form factor medical cart that can be wheeled from room to room and takes up little space.

Pain is pervasive. In the United States alone, in spite of having access to modern healthcare, about 25.3 million adults, or 11.2 percent, have experienced pain every day for the previous three months, and nearly 40 million adults (17.6 percent) had severe pain.¹ At some point in our lives, we will experience acute or chronic pain due to injury or illness.

Traditionally, doctors treat pain with recommendations for physical therapy and medication. However, pain can continue to persist despite treatment or, in the case of prescription drugs like opioids, create undesirable effects and addiction or dependence.

“Now we can say, I understand that you’re having a lot of pain, and it’s involving every aspect of your life. Let us help you to lessen that pain, teach you some ways in which you can make that pain less of your life and enjoy your life more fully.”

– Dr. Shorin Nemeth
Medical Director for Pain Services and Medical Director for Oncology Palliative Care,
Providence Health and Services, Portland, Oregon



Dr. Shorin Nemeth

VR software-based programs hold exciting new promise in treating persistent pain without drug use by helping the brain recircuit pain pathways.

“What was attractive to me about virtual reality was that it took what we know about treating pain and pain medicine and put it into practice,” says Dr. Shorin Nemeth, Medical Director for Pain Services and Medical Director for Oncology and Palliative Care at Providence Health and Services in Portland, Oregon.

“What virtual reality does is take away the ability of the brain to fully process pain,” Dr. Nemeth says. “It takes your mind off of the pain and shows your mind that it can do something else, brings it to a different world, allows you to have a different experience.”

How VR Helps with Pain

Although medicine is “still struggling to understand exactly how virtual reality works, there have been some studies using functional MRI that show less active portions of the brain dedicated to processing pain when we use virtual reality,” Dr. Nemeth says.

VR reroutes the brain’s activity away from what it’s used to focusing on, which—in many of his patients—is pain. “For instance, if we are an Olympic swimmer, then the motor section of our brain is going to be very well developed for [swimming],” he explains. “The more we do it, the more the body is going to focus on it. Similarly with pain, the more pain we have, then the brain rewires to think, ‘This is a significant thing in this person’s life. I need to pay more attention to it.’”

The brain’s capability to do this—called “neuroplasticity,” in response to an individual’s behaviors, experiences and emotions—is well studied. The unique aspects of VR not present in other therapies (i.e., immersive, multisensory features) have shown great potential in rehabilitation therapy.²

Requirements for VR Use in Pain Treatment

VR has been used in numerous studies involving patient rehabilitation and care, but Dr. Nemeth wanted to try a technology suited for his patients. “We looked at a lot of different things in the hardware as well as the software,” he says. Because most of his patients had just had major surgery for cancer, Dr. Nemeth “did not want anything that could potentially stimulate further nausea or dizziness.”

Next, Dr. Nemeth wanted “the technology in the best current state that we can find. And that meant the best graphic resolution, the

most robust experience,” he says. “The more processing of the brain that we can harness, the more likely we will be to decrease that patient’s pain.” That meant the technology had to include auditory stimulation, music, visual stimulation and a minimal requirement for movement since some patients had a limited range of motion.

These requirements led Dr. Nemeth and his team to the Firsthand/HP/Intel/HTC VR technology, which was tested in a five-month clinical trial last year. Twenty-nine Providence Hospital cancer patients used the VR technology to treat their pain while in the hospital. The experiences of these patients were then compared to a database of similar patients who had undergone the same types of surgery for cancer but did not use the VR technology.

Patient-Directed, Visually Rich and Immersive Experiences

The VR software-based program created by Firsthand Technology was run on an HP EliteDesk 800 G3 Tower VR Workstation powered by Intel Core™ i7 processors and HTC Vive VR headsets and controllers.

Patients could choose one of two VR applications by Firsthand Technology, either *Cool!* or *Glow*. Both provide a deeply immersive experience designed to relieve pain while increasing mindfulness to help patients develop greater resilience. In *Cool!*, the patient journeys through a self-guided tour of jewel-encrusted caves and crystalline streams. Users feed rainbow trout to a giant otter, with surprise elements lurking at different points of the journey. In *Glow*, patients enter a world of play with magic and light, gathering fireflies in an evening moonlit setting or coaxing a lantern up from a silent pool. Both experiences were chosen because their settings minimize motion simulation while providing the best graphic experience and resolution.

Both applications, which can be started by patients without assistance by touching an onscreen button, allow users to either drive the interaction with VR controllers or lie back and watch events happen through the headset. With *Glow*, the patient can wear a heart rate sensor that links to the solution’s biofeedback feature. More fireflies appear on-screen the more the patient relaxes and lowers their heart rate.

The data-intensive solution is calibrated to avoid unnecessary stimulation. “These are patients who had major surgery for cancer and may have nausea,” Dr. Nemeth says. “It helped that the software designers actually have motion sickness, so when they designed the program, they made sure it didn’t cause that.”



The *Cool!* VR application gives users rich, interactive experiences that help distract the brain from pain while also building mindfulness and resilience.

A Highly Promising Treatment

The study was designed to see if there was a trend toward “meaningful clinical impact” with virtual reality, Dr. Nemeth says. “And we did show a 30 percent reduction in pain, and about a 20 percent reduction in opioid utilization.”

“Seventy percent of the patients said they would use it again,” he says.

Benefits for Staff and Administrators

“In the hospital, we have to make sure that the technology is easy to use for the staff and the patient,” Dr. Nemeth adds. The VR technology offers a number of benefits for hospital staff:

- Integration with medical workflows in small footprint
- Simple setup with minimal nursing staff needs
- Included staff support and training

“And we showed a significant administrative cost savings in this pilot study,” Dr. Nemeth says.

Creating Better Care and Higher Quality of Life

“We tested what we felt was a best-case scenario at the time, the most engaging technology, using software that was specifically written for this type of purpose,” Dr. Nemeth says.

“Our model of pain care here is to try and empower the patients so that they understand what’s going on with them,” Dr. Nemeth says, “and that they have some tools that are available to them to help them deal with their pain.”

For more about Firsthand Technology’s *Cool!* and *Glow* VR software, go to firsthand.com/vr-software.

To learn more about HP health solutions, visit hp.com/go/healthcare.

Our partners



For more about HP VR hardware, go to hp.com/go/vr.



1. 2012 National Health Interview Survey, National Institutes of Health, U.S. Department of Health and Human Services.

2. Cheung, Katharine L.; Tunik, Eugene; Adamovich, Sergei V.; and Boyd, Lara A. 2014. “VR and Neuroplasticity,” *Virtual Reality for Physical and Motor Rehabilitation*. Editors: Weiss (Tamar), Patrice L.; Keshner, Emily A.; and Levin, Mindy F.

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