Virtual medicine: how virtual reality is easing pain, calming nerves and improving health

Virtual reality is thought to create an immersive distraction that restricts the mind from processing pain.

Not so far in the future, doctors might prescribe a virtual beach vacation to calm aches and pains, in lieu of pharmacotherapy. Insurance companies might offer scenic tours of Icelandic fjords to lower blood pressure, instead of doubling up on drugs. Psychiatrists might treat social phobia by inviting patients to a virtual dinner party. Hospitals may immerse children in a fantastical playland while they receive chemotherapy. These advances are beginning to occur because of virtual reality (VR) — the mind-bending computer technology that nudges our brains into thinking we are somewhere else. Users of VR wear a pair of goggles with a close-proximity screen that creates a sensation of being transported into lifelike, three-dimensional worlds (Box 1). For readers who have not yet tried VR, it may be hard to imagine how convincing the technology can be.

For decades, scientists have been studying the health benefits of VR for ailments ranging from burn injuries to stroke to post-traumatic stress disorder. Literature from pioneers such as Hoffman, Rizzo, ‘Rothbaum and Bordnick, among many others, reveals that VR has the potential to reduce pain, manage anxiety and improve mental health across a range of conditions. However, the technology has been too expensive, unreliable and unwieldy for the research to translate beyond the pages of academic journals and doctoral dissertations. This is now changing with the availability of low cost, portable and high quality VR headsets and software, all of which is supporting a new discipline called therapeutic VR. This brief review describes how VR is being used as a drug-free therapeutic intervention across a range of clinical scenarios and summarises the evolving evidence supporting its impact on patient outcomes.

Distraction therapy for pain

VR provides an immersive, multisensory and three-dimensional environment that enables users to have modified experiences of reality. To date, VR has been used in numerous clinical settings to help treat anxiety disorders, control pain, support physical rehabilitation and distract patients during wound care. For example, VR coupled with medication is effective in decreasing pain during bandage changes for severe burns. Similarly, VR reduces pain and provides positive distraction during routine procedures, such as intravenous line placements and dental procedures. Other studies reveal that VR helps manage chronic pain conditions, including complex regional pain syndrome and chronic neck pain. By stimulating the visual, auditory and proprioception senses, VR may act as a distraction to limit the user’s processing of nociceptive stimuli. However, the existing literature is limited by varying control groups, heterogeneous quality, and often small sample sizes.

In a recent study, our group at Cedars-Sinai Medical Center in Los Angeles evaluated the role of VR in hospitalised patients with pain. We selected VR because our hospital is seeking ways to reduce pain while also reducing the need for additional pharmacotherapy, such as opioids. For this reason, we conducted a study to compare a three-dimensional VR pain distraction experience versus a two-dimensional high definition nature video in a cohort of diverse patients with a pain intensity of three or over out of ten (n = 50 subjects per group). Patients watched a 15-minute VR experience called Pain RelieVR, specifically designed to treat pain in patients who are bedbound or have limited mobility...
Sixty controls (pain reduction in the VR cohort was greater than in manoeuvring their head towards the targets. The mean attempt to shoot balls at a wide range of moving objects by experience that takes place in a fantasy world where users perception. Most proposed mechanisms attribute the it remains unknown exactly how VR works to reduce pain particularly when wearing headsets with suboptimal nausea have been described in a subset of users, Importantly, we did not document adverse events from VR during the trial, although temporary vertigo and blasts. Data reveal that soldiers repeatedly exposed to the thick scent of burning oil and the sound of concussive brainstem cravings not otherwise possible during typical alcoholism might hold a session in a bar, triggering environmental, therapeutic VR. Using this approach, VR can meet their therapist from anywhere in the world face-to-face and engage in talk therapy. With VR, clients relationship. Traditionally, therapists and clients sit temporary vertigo and nausea have been described in a subset of users, particularly when wearing headsets with suboptimal processor speeds.

It remains unknown exactly how VR works to reduce pain perception. Most proposed mechanisms attribute the benefit to simple distraction. Additional research is underway to study the neurobiological mechanisms of VR across pain conditions and to measure whether its benefits extend beyond the immediate VR treatment period. For example, we are currently conducting a larger, randomised controlled trial to evaluate long-term pain outcomes and resource utilisation related to therapeutic VR (ClinicalTrials.gov NCT02887989). In addition, we are measuring salivary cortisol levels before and after VR treatment compared with a control condition; we will report our findings as they become available in the future.

In a recent meta-analysis of randomised controlled VR trials, we identified 11 studies comparing VR versus a control condition in diverse populations. The studies addressed burn dressing changes, obesity management, cancer pain, physical trauma, stroke rehabilitation and traumatic brain injury. VR was effective in most of these studies and well tolerated in all reports. However, the studies were generally small and of heterogeneous quality. We concluded that the VR literature will benefit from larger, higher quality studies, but in the meantime, the existing literature is supportive of VR as a broadly effective therapy.

**Psychotherapeutic applications of virtual reality**

Much of the therapeutic VR research has focused on using the technology to manage phobias, anxiety and related conditions through VR-enabled meditation and exposure therapy. For example, Rizzo and colleagues have studied the role of VR for treating soldiers mentally scarred by the calamity of war. By virtually placing veterans into the thick of battle using a VR program called Bravemind, the thick scent of burning oil and the sound of concussive blasts. Data reveal that soldiers repeatedly exposed to the trauma of war, complete with the vibration of rolling Humvees, can achieve improved quality of life. However, this work requires further validation and reproduction in other laboratories before it can be considered standard of care for managing post-traumatic stress disorder. VR is also being used by investigators such as Rothbaum and colleagues for patients with phobias to literally face their fears (eg, spiders for arachnophobia, dizzying height for acrophobia etc) while in the relative safety of a VR headset.

VR has potential to disrupt the client—therapist relationship. Traditionally, therapists and clients sit face-to-face and engage in talk therapy. With VR, clients can meet their therapist from anywhere in the world through virtual tele-psychiatry. Using this approach, clients and therapists view each other’s avatar in tailored therapeutic environments. For example, a person with alcoholism might hold a session in a bar, triggering brainstem cravings not otherwise possible during typical therapy.
Neurocognitive applications of virtual reality

Researchers are now exploring the intersection between VR and neuroscience by studying the role of VR in stroke rehabilitation, autism and dementia. For example, using a program called MindMaze (www.mindmaze.com), patients recovering from a stroke can practice fine motor tasks and steadily regain control over their body and mind by rehabilitating in virtual worlds. Similarly, a program called Brain Power (www.brain-power.com) is being used to teach children with autism how to emotionally decode body language by superimposing facial interpretations over actual faces through a process of augmented reality—a variant of VR in which virtual images are blended with the surrounding, real world environment. In the United Kingdom, geriatricians are using VR in nursing homes to awaken the spirits of older people with dementia. By transporting patients to exotic destinations and engaging them with immersive games, researchers are uncovering latent personality traits and even compelling patients with dementia to sing joyously from the moribund depths of bewilderment (www.youtube.com/watch?v=N3ywcoqR4Co).

The future of therapeutic virtual reality

Despite increasing awareness about VR and its potential benefits, it remains unclear whether and how best to scale this technology in everyday clinical practice. There are also open questions about whether some patients are willing to accept VR in the first place. We previously assessed the acceptability of VR in hospitalised patients and found that most patients found VR to be a positive and pleasant experience that eases anxiety and provides an escape from the confines of a distressful illness experience. Most patients reported a willingness to use VR again if given the opportunity. However, we also found that younger patients are more willing to use VR than older patients; that some patients found the technology uncomfortable, intrusive or confusing to use; and that patients occasionally reported that the headsets were difficult to operate or of unclear benefit. In short, our research suggests that introducing VR into clinical practice requires careful thought, consideration of patient preferences and an understanding of the advantages and disadvantages of this emerging technology.

Finally, if VR is truly a therapy, then the next step is to develop a “VR pharmacy.” Just as doctors prescribe the right dose of a medicine, “virtualists” are now prescribing the right VR experiences at the right time for the right patients. In many ways, a VR headset is a similar to a syringe: both are merely devices that deliver a therapy. The device itself is unimportant; it is what passes through the device that matters. The challenge now is to develop and rigorously test the clinical benefits of VR in a variety of clinical disorders, and then to determine cost-effective approaches for delivering VR to the front lines of care.

Acknowledgements: Support for this work is provided by the Marc and Sheri Rapaport Fund for Digital Health Sciences and Precision Health.

Competing Interests: I have received a research grant, administered by Cedars-Sinai Health Services, from appliedVR (Los Angeles, CA). I have no equity, royalty, board positions or other relevant financial relationships to disclose with appliedVR or any other company with a product or service mentioned in this article.

Provenance: Commissioned; externally peer reviewed.

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References are available online at www.mja.com.au.


