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A Virtual Reality Environment and Adjuvant for Managing Chronic Pain

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Purpose

An estimated 15-29% of the population currently suffer from chronic pain (see Boulanger et al., 2007). Such individuals also show decreases in mobility and social interaction as their illness progresses (Statistics Canada, 2008). We have formed a research group composed of pain physicians, neuroscientists, psychologists, computer scientists, and artists. Together, we are engaged in several projects that collectively seek to help individuals living with chronic pain deal with their pain its sequelae.

Previous research has demonstrated that immersive Virtual Reality (VR) is effective for the treatment of acute pain (e.g., Hoffman et al., 2007). In fact, the magnitude of VR-induced analgesia has been shown to be comparable to that of opioid analgesia (Hoffman et al., 2007); without tolerance to its analgesic effects after repeated administrations (Hoffman et al., 2001). Accordingly, immersive VR has been termed a "non-pharmacological analgesic."

Given the demonstrated potential of VR to serve as a powerful treatment for acute pain, can similar therapeutic benefits be observed when treating individuals suffering from chronic pain with VR? We are building several VR environments to address this question. One such environment engages the immersant in a walking meditation. We chose to use a meditation-based environment for this VR-based therapy because we have previously demonstrated the effectiveness of VR for encouraging meditative states (Shaw, Gromala, & Seay, 2007). The walking form of meditation was chosen since we wanted to see if we could simultaneously address one of the aforementioned secondary aspects of chronic pain: decreases in mobility.

Method

Participants with chronic pain will be recruited from a complex pain clinic in Vancouver, Canada; testing will occur in that clinic for the Virtual Meditative Walk. Participants will be assigned to one of four conditions, each lasting 20-min: VR-meditative walk (VR-W), VR-only (VR-O), walk-only (W-O), and sitting-only (S-O).

VR-W participants will be placed on a treadmill with a stereoscopic head-mounted display (HMD), and enter the Virtual Meditative Walk: The immersant will be situated in a forest where they can look around and move along a path by ambulating on the treadmill. VR-W participants will have audio guidance on how to perform a walking meditation. VR-O participants will also be situated in the same VR environment as group VR-W, but will sit on a chair rather than use the treadmill. VR-O participants will be passively moved through the VR environment; they will have audio guidance on how to perform meditation. For VR-W and VR-O participants, various components of their physiology will be measured and will have effects on components of the VR environment.

W-O participants will be placed on the treadmill, but will not have the HMD. They will be allowed walk on the treadmill with the same walking-meditation guidance as group VR-W. S-O participants will sit in the same chair as the VR-O group, with the same audio guidance as group VR-O.

At the end of the test period, pain modulation in all participants from each of the groups will be assessed via Diffuse Noxious Inhibitory Control (DNIC) and Horizontal Visual Analog Scale.

Results

In our previous work, Meditation Chamber, we tested 411 users and found that people experienced a higher level of relaxation compared to control subjects who did not use immersive VR. This was inferred from an observed decrease in galvanic skin response and an increase in subjective rating of relaxation.

Our present work, Virtual Meditative Walk, aims to extend those findings by examining these and other measures (e.g., DNIC) under various conditions, as described above. Our hypothesis is that the VR-W and VR-O groups will have comparable levels of analgesic benefits in the short term, as assessed via the DNIC and the Horizontal Visual Analog Scale (HVAS). However, we believe that there will be added benefit to the chronic pain patient of experiencing a meditative walk over just stationary VR, especially if done repeatedly. For the act of walking both challenges their own perception of their mobility impairment and serves as a beneficial exposure to ambulatory exercise in a group of individuals who often avoid movement.

Conclusions

Although immersive Virtual Reality (VR) technology consistently offers a provocative, potential form of pain relief, the mechanism for its efficacy remains unknown. However, the fact that analgesic effects of opioids and VR are additive (Hoffman et al., 2007) suggests that VR-induced analgesia is not mediated through the endogenous opioid transmitter system. For the past 15 years, research on pain and VR has focused exclusively on acute pain. Our focus on chronic pain is novel and requires a fundamentally different approach--based on the etiology and phenomenology of chronic pain.