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Non-Immersive, Virtual Reality Mirror Visual Feedback for Treatment of Persistent Idiopathic Facial Pain

Dear Editor,

This letter describes a preliminary proof-of-concept test of a novel, non-invasive, virtual reality mirror visual feedback (VRMVF) therapy for persistent idiopathic facial pain.

Persistent idiopathic face pain (PIFP) shares some characteristics with complex regional pain syndrome (CRPS) type 1: The pain develops after a relatively minor noxious event; is not associated with a specific nerve injury; and results in constant, severe, and often disabling pain. Patients with both conditions may develop allodynia and/or thermal sensitivity, and may limit movement of the affected part to minimize pain. Mirror visualization feedback (MVF) is one approach used for CRPS that might also prove useful in treating PIFP. In 1996, Ramachandran discovered that MVF therapy might mitigate phantom limb pain in amputees [1]. Attempts to expand on this use of MVF have included efforts to treat phantom limb pain, fibromyalgia [2] CRPS [3] and facial pain [4] both in the original format and using virtual reality (VR) [5–7].

We theorized that the similarities between CRPS and PIFP might make a MVF therapy that relies on painless touch effective in treating PIFP as well. In our method, a digital model (or "avatar") represents the patients head and neck, with the computer screen serving as the "mirror." This method would allow the visual illusion of touch on the affected side without requiring actual touch on the patient's unaffected side, eliminating contradictory tactile input. We created a virtual "mirror" consisting of an animated mirror image of the patient shown on an ordinary laptop monitor. We hoped to create the illusion of touch on both sides of the patient's head and neck by synchronizing actual touch on the unaffected side of the patient's body with the visual input of a cotton swab "touching" the digital avatar. Our trial was designed to test the feasibility of non-immersive VRMVF treatment on PIFP, including therapists' ability to synchronize their movements with the movements on the screen, and that the treatment would not significantly increase patients' pain or cause other ill effects.

Three patients were recruited by a single investigator (TC), all of whom met International Headache Society (IHS) (revised) criteria for PIFP. Two proceeded to completion of the trial. Both patients who completed the trial had constant or near-continuous unilateral face pain. In addition, patient A had allodynia in the distribution of her face pain. Patient B had hypersensitivity to both light touch and pinprick in the distribution of her face pain but no allodynia. The general neurologic examination was normal in both patients, and neuroimaging was unremarkable in both patients. The trial was approved by the Duke University Medical Center Institutional Review Board (IRB) prior to patient enrollment. The therapy consisted of four sessions: a sham/control session in which no mirror imagery techniques were used and three active sessions in which the patient was seated in front of their virtual "reflection." During the first session, the patient was seated in front of an inactive monitor. This session served as a control and also allowed us to determine whether touch alone affected patients' pain. The therapist stroked five areas of the unaffected side of the patient's face and neck, using the tip of a cotton swab, for 1 minute per area. During the second, third, and fourth sessions, the patient was seated in front of a live laptop and shown two different movies showing a mirror-image digital model of the patient's face While the patient watched the first movie, which showed "touching" of the unaffected side of the patient's face, the investigator followed the action of the movies by stroking the patient's face with a cotton swab in time with the recorded movements. During the second movie, the investigator mimicked the movement of the swab on the screen but did not actually touch the subject's affected side with the swab (Figure 1).

Treatment was discontinued after the planned four sessions. Patient A, who presented with allodynia, reported a reduction in pain sustained past the time of treatment

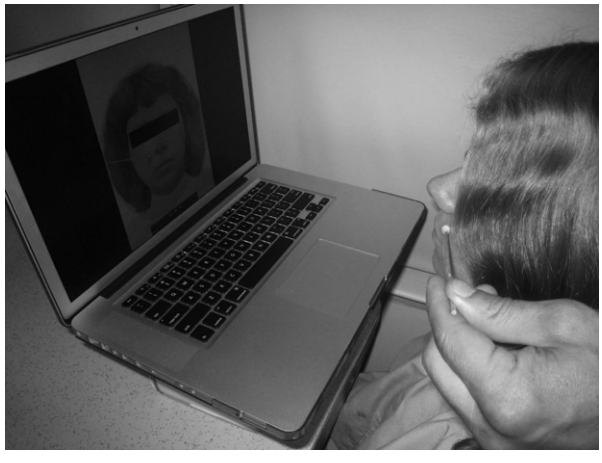

Figure 1 Photograph showing position of subject during treatment.

as measured in average pain during the week following the treatment compared with average pain reported during the year previous to treatment. Interestingly, patient A also reported a slight increase in activation on the unaffected side immediately after treatment. She stated that she would be willing to continue the treatment and felt that it had a "good effect." While patient A continues to take medication, at a 6-month routine follow-up visit, she had decreased her medication use to every other day. Patient B, who reported hyperesthesia but did not have true allodynia, did not report any change, although she stated that she would be willing to continue the treatment.

It should be noted that the fact that both patients were willing to continue with the treatment, even though only one felt that it was having an effect, suggests that the experience of VR may be appealing enough to distort the effects of therapies based on it. Future trials must be especially carefully designed to control for the effects of distraction and placebo on pain.

Because the patient with allodynia appeared to experience some benefit, future trials should also document the presence or absence of allodynia to determine if the presence of allodynia predicts patient response to MVF therapy. In a study by Cacchio et al. [8], using MVF for extremity pain, allodynia decreased significantly in the study group; however, it was not clear if the improvement in allodynia correlated with the improvement in pain.

Based on this study, we believe that non-immersive VRMVF can be safely performed in patients with PIFP. The technical aspects were easily accomplished with minimal equipment, making a similar technique accessible to any facility with a laptop or desktop monitor. While the small scale of this trial precluded demonstration of the effectiveness of this non-immersive VRMVF therapy, our results show no adverse effects during the period of the trial, and support further investigations of this technique for treating PIFP. Further trials should include sufficient numbers to compare control and active treatments, as well as assessment of whether presence or absence of allodynia influences response to VR treatments.

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