



Using mirror visual feedback and virtual reality to treat fibromyalgia

V.S. Ramachandran^{a,b}, Elizabeth L. Seckel^{a,*}

^a Center for Brain and Cognition, UCSD, La Jolla, CA 92093, United States

^b 9500 Gilman Dr. La Jolla, CA 92093, United States

ARTICLE INFO

Article history:

Received 24 April 2010

Accepted 1 July 2010

SUMMARY

Fibromyalgia is a condition characterized by long term body-wide pain and tender points in joints, muscles and soft tissues. Other symptoms include chronic fatigue, morning stiffness, and depression. It is well known that these symptoms are exacerbated under periods of high stress. When pain becomes severe enough, the mind can enter what is known as a dissociative state, characterized by depersonalization – the feeling of detachment from one's physical body and the illusion of watching one's physical body from outside. In evolutionary terms, dissociative states are thought to be an adaptive mechanism to mentally distance oneself from pain, often during trauma. Similar dissociative experiences are reported by subjects who have used psychoactive drugs such as ketamine. We have previously used non-invasive mirror visual feedback to treat subjects with chronic pain from phantom limbs and suggested its use for complex regional pain syndrome: once considered intractable pain. We wondered whether such methods would work to alleviate the chronic pain of fibromyalgia. We tested mirror visual feedback on one fibromyalgia patient. On 15 trials, the patient's lower limb pain rating (on a scale from 1 to 10) decreased significantly. These preliminary results suggest that non-invasive dissociative anesthetics such as VR goggles, ketamine, and mirror visual feedback could be used to alleviate chronic pain from fibromyalgia. This would furnish us with a better understanding of the mechanism by which external visual feedback interacts with the internal physical manifestation of pain.

© 2010 Elsevier Ltd. All rights reserved.

Introduction

Fibromyalgia

Fibromyalgia is a debilitating syndrome characterized by widespread chronic musculoskeletal pain, muscle stiffness, sleep disturbances and fatigue [1]. The American College of Rheumatology criteria for the diagnosis of fibromyalgia consists of pain in all four body quadrants as well as pain upon palpation at 11 or more of 18 specific tender point sites [2]. Despite being relatively common, it has received very little attention from the medical establishment. Its pathogenesis is unknown although “psychological” factors such as stress can exacerbate the symptoms. It is also associated with tactile allodynia.

Dissociative states

What we call pain is multi-layered; it is possible to separate the sensory component of pain from the affective motivational response – the “agony” – of pain. One situation where this happens

is in a dire emergency where it would be futile to struggle; the mechanism is an evolutionary adaptation (to discourage further predatory reflexes). When Livingstone was being mauled by a lion – he had the experience of watching himself from outside his body with equanimity. He felt the sensation of pain but not the agony. Similar mental states are reported by women who have been raped. There is some evidence that such “dissociative” states are evolutionarily adaptive mechanisms mediated by frontal inhibition of the anterior cingulate (which receives pain signals from the insula). Indeed damage to the efferent pathway from the insula can lead to dissociation; even laughter in the face of pain [3]. Ketamine anesthesia can create similar dissociations. Subjects report that they have “out-of-body” experiences – as though they are watching their own body (and “its” pain) from outside.

Hypothesis

We have previously used illusions of body image – such as those produced using mirrors [4–7] to alleviate chronic phantom limb pain as well as the pain of RSD [8]; two forms of pain that have long been regarded as intractable. Inspired by this we propose that experiences similar to out-of-body experiences using mirrors or ketamine or VR technology can be used as a non-invasive dissociative “anesthetic” to alleviate the pain of fibromyalgia.

* Corresponding author. Tel./fax: +1 818 970 6861.

E-mail addresses: vramacha@ucsd.edu (V.S. Ramachandran), eseckel@ucsd.edu (E.L. Seckel).



Fig. 1. Two mirrors are aligned at a 90 degree angle. When the subject centers her body at one mirror's edge and lifts her (left) leg, this leg is reflected in the same mirror. Although the other (right) leg is grounded, the illusion of both legs being lifted is created in the other mirror and results in a feeling of weightlessness.

Provisional data

We tried an experiment to test the idea on a 22-year old woman who was neurologically completely normal with no history of mental illness. She had experienced chronic widespread pain since the age of 10 and had been diagnosed as having fibromyalgia at the age of 16. Her chronic intermittent pain was most profound in her legs, especially the shins.

We created an arrangement in which two tall mirrors (7 feet by 2 feet) were propped up on the floor with edges at right angles to each other and reflecting surfaces facing each other. If the subject stands with her nose touching one edge of the mirror, she sees a reflection of the right side of her body in the far mirror (see Fig. 1). If she now elevates one leg alone (in this case the left leg) she gets the illusion that the right leg is also going up even though it is of course standing vertical, supporting the body. This creates a surprising effect; the subject feels she is floating weightless in space. Extraordinarily this seemed to alleviate the pain. We repeated the procedure 15 times, each trial

lasting 30 s with inter-trial interval was 5 min. Pain was rated on a scale of 1–10.

As a “placebo” control we again used the mirrors at a 90° angle to one another. If the subject stands between the mirrors, centering herself in the right angle formed by the mirrors' edges, she sees the right side of her body in the opposite reflection. If she now elevates one leg alone (the right leg) she gets the illusion that the opposite (left) leg is going up and the other (right) leg is stationary.

The results were clear: on 15 trials lower limb pain diminished on average from 8.00 to 4.93. During the placebo condition, pain diminished on average from 8.00 to 7.33.

Discussion

These are informal observations on a single subject and are inconclusive given the notorious susceptibility of pain to placebo and suggestion. Nonetheless, the observation suggests that mirrors, virtual reality or ketamine might be worth exploring as potential new treatments for fibromyalgia.

Conflicts of interest statement

None declared.

References

- [1] Schweinhardt P, Sauro KM, Bushnell MC. Fibromyalgia: a disorder of the brain? *Neuroscientist* 2008;14(5):415–21.
- [2] Wolfe F, Smythe HA, Yunus MB, Bennett RM, Bombardier C, Goldenberg DL, et al. The American college of rheumatology 1990 criteria for the classification of fibromyalgia. Report of the Multicenter Criteria Committee. *Arthritis Rheum* 1990;33:160–72.
- [3] Ramachandran VS, Blakeslee S. *Phantoms in the brain*. New York: William Morrow; 1998. p. 208.
- [4] Ramachandran VS, Rogers-Ramachandran D. <http://cbc.ucsd.edu/pdf/Synaesthesia_in_Phantom_Limbs-P_Royal_Soc.pdf> Synaesthesia in phantom limbs induced with mirrors. *Proc Royal Soc London* 1996;263:377–86.
- [5] Ramachandran VS, Rogers-Ramachandran D, Cobb S. Touching the phantom limb. *Nature* 1995;377:489–90.
- [6] Altschuler EL, Ramachandran VS. <http://cbc.ucsd.edu/pdf/mirrors_perception.pdf> A simple method to stand outside oneself. *Perception*, 2007;36(4):632–4.
- [7] Ramachandran, VS, Altschuler, E. [http://cbc.ucsd.edu/pdf/Synaesthesia_in_Phantom_Limbs - P_Royal_Soc.pdf](http://cbc.ucsd.edu/pdf/Synaesthesia_in_Phantom_Limbs_-_P_Royal_Soc.pdf). The use of visual feedback in restoring brain function. *Brain Sci* 143:594–6.
- [8] Ramchandran VS. Decade of the brain symposium. La Jolla CA 92014: UCSD School of Social Sciences; 1996.