



Annual Review of CyberTherapy and Telemedicine

A Healthy Mind in a Healthy Virtual Body:
The Future of Virtual Reality in Health Care

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Annual Review of CyberTherapy and Telemedicine, Volume 15

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6540 Lusk Boulevard, Suite C115
San Diego, CA 92121

ISBN: 1554-8716

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Printed in the United States of America

Journal Web site: <http://www.arctt.info>

Interactive media Institute Website: <http://www.interactivemediainstitute.com>

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Chronic pain treatment through Virtual Reality

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Abstract. Chronic pain is a notable issue of public healthcare, causing enormous direct and indirect costs, and a reduction of the quality of life in the affected patients. In this study, we have used Virtual Reality (VR) as a method to reduce stress, anxiety and pain in patients affected by chronic pain. We examined two cohorts of patients: an experimental group and a control group. The patients in the experimental group were administered eight VR sessions, each of those lasted thirty minutes, while the control group had a standard therapy. The results are encouraging: they demonstrate the efficacy of VR treatment and the safety of the method.

Keywords. Chronic pain, palliative care, virtual reality, analgesia.

1. Introduction

The definition of pain was given by the IASP (International Association for the Study of Pain) in 1979. According to this definition, the pain is described as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” [1]. Said definition puts emphasis not only on the objective component of the pain, but also on the subjective part. Being an unpleasant experience, there is also an emotional charge that accompanies the pain [2]. Therefore, pain therapy not only aims to restore of the damaged tissue, but also to re-establish the psychological equilibrium of the patient. Furthermore, depression, anxiety, denial and muscle weakness are often associated with chronic pain [3]. In particular, the relation between pain and depression is not a mere cause-effect interaction, but the two factors are capable of influencing each other, such that depression can amplify the perception of pain and vice versa. The economic and social costs linked to chronic pain are enormous, since this has been identified as one of the main causes of loss of function and productivity in several countries.

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Pharmacological intervention is the main therapy for the patients. This is able to reduce the inflammation and the levels of pain perceived, but also brings important side effects. Furthermore, when tolerance occurs, it's necessary to increase the amount of drug administered to maintain the desired level of analgesia.

2. Methods

A group of 11 patients, composed of 8 women and 3 men was recruited in sanitary structures and divided in two groups: an experimental group and a control group

Table 1: Population characteristics

	Experimental group	Control group
	$n = 6$	$n = 5$
Age (Mean $\pm$ SD)	54.8 ± 12.6	57.4 ± 8.64
(range)	38 ± 70	44 ± 70
Gender (M, F)	3.3	0.5

Subjects in the experimental group were administered eight VR treatment sessions of thirty minutes each, two times per week. The VR scenarios used were “Enchanted Forest”, “Castle” and “Cliff”, developed at The Virtual Reality Medical Center, San Diego, CA. The worlds help evoke relaxation and deep breathing [4]. The control group adhered to the classical therapy, consisting of pharmacological intervention and thermotherapy, magnetotherapy, and ultrasonic treatment.

VR scenarios were run in a PC, and the environments were visualized on a monitor, configuring a non-immersive VR experience. The movements through the environments were managed with the help of a joystick and the sound was reproduced by a pair of headphones.

3. Results

Table 1. Results at Wilcoxon test

Test-retest	Experimental (n=6)	Control (n=5)
McGill	$z = -2.201, p = 0.028^*$	$z = -0.447, p = 0.655$
BPI Severity	$z = -2.207, p = 0.027^*$	$z = -1.826, p = 0.068$
BPI Interference	$z = -2.201, p = 0.028^*$	$z = -1.633, p = 0.102$
STAI Y-1	$z = -0.943, p = 0.345$	$z = -1.604, p = 0.109$
STAI Y-2	$z = -1.572, p = 0.116$	$z = -1.841, p = 0.066$
BDI	$z = -1.261, p = 0.207$	$z = -1.604, p = 0.109$
VAS	$z = -2.032, p = 0.042^*$	$z = -1.461, p = 0.144$
SUDS	$z = -1.732, p = 0.083$	$z = -1.414, p = 0.157$

*Significant $p < 0.05$

The results of the tests show the efficacy of the two therapies (the VR treatment and the classic therapy). In the experimental group there is a significant reduction in the scores obtained in the McGill Pain Questionnaire, Brief Pain Inventory severity and interference and in the Visual Analog Scale. A tendency to significance is shown in the Subjective Units of Distress Scale. In the control group there is not a meaningful reduction of the scores, except for a tendency to significance in the Brief Pain Inventory severity.

4. Discussion

In the experimental group, the reduction in the McGill, BPI severity and interference and STAI scores indicates that the therapy is efficient and powerful. The results obtained suggest that there has been a decrease in the pain experienced by the subjects, in the interference with daily activities. Instead, the subjects in the control group had a meaningful reduction of the scoring only in the BPI severity test. This shows that the subject had a reduction of the intensity of the pain experienced, even if the amount of this reduction is not as high as the one obtained in the experimental group. The VR treatment has showed to be an excellent tool to induce analgesia. Both therapies lasted four weeks, showing that in the same quantity of time, the VR therapy is more efficient to induce analgesia than the classical therapy.

5. Conclusions

VR treatment is still to be considered the future of low and mild pain syndromes, since the more studies are carried out, the more the advantages of said technique continue to show. The absence of use of pharmacological analgesics, and the minimal invasiveness of the procedure are capable of encouraging the patients to start the therapy, and helping to reach a certain level of analgesia in just one month.

It should be acknowledged that these results were obtained with a non-immersive VR technology, in which the VR environments were displayed on laptop computer instead of a head mounted display. The implementation of a head mounted display could give a greater sense of immersion in the VR, distracting the patients more efficiently and thus strengthening the effects of the therapy.

At least, the results are encouraging, but still the number of patients has to be increased.

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