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Virtual Reality for the Induction of Positive Emotions in the Treatment of Fibromyalgia: A Pilot Study over Acceptability, Satisfaction, and the Effect of Virtual Reality on Mood

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Abstract

One of the most important aspects of fibromyalgia syndrome (FMS) is its impact on quality of life, increasing negative emotions and dysfunctional coping strategies. One of these strategies is to avoid activities, especially meaningful activities, which reduces positive reinforcement. Commencing significant daily activities could enable chronic patients to experience a more fulfilling life. However, the main difficulty found in FMS patients is their willingness to start those activities. Promoting positive emotions could enhance activity management. The aim of this paper is to present a description of a system along with data regarding the acceptability, satisfaction, and preliminary efficacy of a virtual reality (VR) environment for the promotion of positive emotions. The VR environment was especially designed for chronic pain patients. Results showed significant increases in general mood state, positive emotions, motivation, and self-efficacy. These preliminary findings show the potential of VR as an adjunct to the psychological treatment of such an important health problem as chronic pain.

Introduction

Fibromyalgia syndrome (FMS) is a chronic musculoskeletal pain condition of unknown etiology, characterized by widespread pain and muscle tenderness, and often accompanied by fatigue, sleep disturbance, and depressed mood.[1] It is estimated that around 2–4% of the general population suffer from FMS.[2] FMS is a complex condition involving biological, psychological, and social factors, which cause a negative impact on patients' quality of life. This condition is becoming an important public health problem because it is associated with an increased use of health services, emergency room visits, and medication, and increased work disability.[3,4] The treatment of FMS has a poor prognosis for recovery,[5] and it is considered a challenge for health professionals. Several studies support that FMS is better addressed from a multidimensional perspective, being more effective than management from single approaches.[6] In this sense, psychological aspects are among the best predictors of disability caused by chronic pain[7] and constitute a promising component in the treatment for FMS. Such programs include various components such as relaxation, mindfulness, cognitive therapy, and activity management. Several studies have tested the efficacy of psychological programs for FMS and have revealed small yet robust effect sizes of short- and long-term efficacy.[8] The conclusion was that psychological programs are promising interventions for FMS, even though there is still room for improvement. Further research is needed to respond more appropriately to patients with FMS.

The use of information and communication technologies (ICTs) in the field of psychological treatments has developed at a fast pace in recent years. ICTs offer different methods that can help to improve the effectiveness of some components of treatment. One of these elements is virtual reality (VR), used for treating a range of psychological disorders.[9,10] In the field of pain, VR has been used mainly in the treatment of acute pain associated with medical procedures.[11,12] However, the use of VR in chronic pain is scarce. A recent systematic review about the use of VR found promising results for the efficacy of distraction for pain reduction.[13] Some researchers have explored the use of a VR mirror in the treatment of complex regional pain syndrome and phantom limb pain.[14,15] The literature on the applications of VR in the field of chronic pain is very scarce. Keefe et al.[16] conducted a review of this issue and found some preliminary studies where VR could be a good approach to

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expose patients to movements that they may fear or avoid due to pain. It has been suggested that mirrors and VR could be potential new treatments for this condition. Our research team realized a pilot study showing the utility of VR to induce relaxation in FMS.[17] Our aim is to contribute to the exploration of the use of VR in the treatment of chronic pain.

Chronic pain is characterized by a loss of valued activities, which has an effect on the mood of the sufferer. The task of making FMS patients become more active is challenging. As a chronic condition, it leads to a dysfunctional pattern of activity that is very difficult to reverse. The activity management component of the program consists of setting goals related to activities that are significant for the patients and getting patients to perform those activities progressively, balancing the period of rest and activity. Feelings such as low mood and fear and symptoms of the condition—pain and, more importantly, fatigue—get in the way of the willingness to perform the activities, causing low motivation and a poor sense of self-efficacy. Positive emotions can help to counteract the effect of these aspects. The influence of positive emotions influences cognitive processes, well-being, and health,[18,19] promoting flexible and creative thinking and playing an important role in building of psychological strength and intellectual and social resources.[20] The promotion of positive emotions may help in the regulation of negative emotions or, in promoting the increase of available resources, to maintain long-term gains and to provide people with the strength to become more resilient. Our research team is currently working on the study of the effect of positive emotions in the treatment of mental and health problems, and in the use of technology to promote well-being.[21]

To achieve this goal, we rely on the potential of VR. We have developed a VR component using an adaptive display for the delivery of an adjunct to the activity management component.[22] The use of multiple sensory multimedia cues (music, images, and videos) that VR offers prompted us to use this technology for inducing positive emotions in FMS patients. Before carrying out a controlled study to analyze the effectiveness of the VR, a pilot study was designed to explore users' opinions and acceptance, and to collect some initial data about its utility to increase positive emotions and promote motivation and self-efficacy.

Materials and Method

Participants

The sample comprised 40 patients, all women ranging in age from 27 to 66 years ($M = 48.8$; $SD = 9.3$) and diagnosed with FMS according to ACR criteria.[23] Of these, 52.5% had an additional diagnosis of anxiety disorder, and 65% of depressive disorder. They have suffered chronic pain for a range of 1–30 years ($M = 10$; $SD = 7.1$). Most of the sample (55%) had an elementary level of education, 12.5% had not finished elementary studies, 15% finished high school, and 17.5% had a university degree. Regarding work status, 47.5% were active workers, 32.5% were housewives, and 20% did not work. Of those who were not working, 12.5% were on sick leave.

Exclusion criteria included severe mental illness, mental retardation, or being involved in the process of obtaining disability compensation. All participants agreed to participate and signed an informed consent form before starting the study.

Measures

Screening and psychological diagnostic assessment was conducted using the Structured Clinical Interview for DSM-IV Axis I Disorder (SCID-I)[24] and the Structured Clinical Interview for DSM-IV Axis II Personality Disorder (SCID-II).[25]

The outcome measures chosen to determine if the VR procedure could produce changes from pretest to posttest were:

- Mood state (MS): Patients were asked to assess their general mood state, using a pictorial scale with seven facial expressions ranging from ''very sad'' to ''very happy.''
- Pain and fatigue intensity: Patients were asked to assess their pain and fatigue intensity, using a numeric rating scale (NRS) comprising 11 points, ranging from 0 = ''no pain or fatigue'' to 10 = ''worst pain or fatigue.''
- Motivation and self-efficacy: Patients were asked to assess their motivation and sense of self-efficacy regarding specific activities that they chose in a previous session, using a NRS comprising 7 points, ranging from 1 = ''none'' to 7 = ''very much.''
- Intensity of several emotions: Participants were asked to rate the intensity of different emotions (joy, sadness, anger, surprise, anxiety, relaxation, and vigor/energy), from 1 = ''not at all'' to 7 = ''completely.''

Following induction, an opinion questionnaire was administered to assess the participants' acceptability and satisfaction regarding the VR. Participants rated four topics using a scale from 1 to 10: ''To what extent are you satisfied with the VR component that you received?''; ''To what extent do you feel that VR was useful for you?''; ''To what extent do you feel that VR annoyed you?''; ''To what extent would you recommend VR to others with the same problem as you?''

In addition, five more questions were administered in order to compare before induction with after induction. Participants were asked to rate on a scale where 1 = ''much worse'' to 7 = ''much better'' the change from before induction to after induction in pain, fatigue, general mood state, motivation, and self-efficacy.

Virtual environment

The configuration used a range of devices: two PC computers, a 3×4 meter screen made of reflective material, two projectors, and a Dolby 7.1 surround sound audio system. The first PC had the graphical outputs from its graphic card connected to the projector, which were used to project the environment onto a metacrilate screen. The second PC hosted the therapist's application and controlled the features of the virtual environment that were shown to the patient.

Participants were placed in front of the screen in groups of six people. One of the therapists was in charge of operating the VR system during the 20 minute session.

The VR environment was an adaptive display named EMMA, developed in the framework of EU funded Project (IST-2001-39192-EMMA, Engaging Media for Mental Health Applications). EMMA is a flexible VR environment that includes five predefined scenarios aimed to induce emotions (desert, beach, forest, snowy landscape, and a meadow). It is possible to change the weather or the time (day and night), and to include sounds, images, and videos. This VR environment has demonstrated its capacity to

FIG. 1. Treatment setting for the delivery of virtual reality (VR) sessions.

induce several emotions[26] and its efficacy in the treatment of stress-related disorders.[27]

In this study, the scenario chosen was the beach, including music, sounds, narratives, and images selected especially to induce positive emotions and promote motivation, self-efficacy, and behavior activation. Figures 1, 2 and 3 show images of the setting and the VR environment.

Melodies with positive valence and high arousal were included from the International Affective Digitized Sounds.[28,29] Besides, other melodies were selected, following two rules: tempo and mode.[30] Research suggests that a fast tempo evokes energy and activation, and a major mode is related to positive mood.[31]

Images were selected from the International Affective Picture System,[32] meeting the criteria of positive valence and high arousal. Other images were also included, selected according to three dimensions: color, brightness, and saturation. Research indicates to evoke positive emotions, it is important to use images with bright and high saturated colors, with a prevalence of green and blue colors.

Table 1. Fragment of the Narrative Included in the VR Procedure

Pain is an important challenge, but with perseverance, courage, optimism and determination you can get what you want to achieve your goals. Don't let pain prevent you from doing what you want to do. Begin with small and short-term goals, and, little by little, progress to bigger and long-term goals. Remember that there is something in you that is bigger than any obstacle.
Now, write your goal on this board, a little goal for this week. Write: I will. … Read it out loud. Your strength is your determination and courage, courage that is inside you, courage that you demonstrate every day, facing pain.
Now, let's walk around the room showing off your goals [walk with the board].
Start doing this activity today; include it in your routine because it is something you want to do. When your energy goes down, remember this session.
If you believe you are tired, you are tired.
If you believe you won't be able to do it, you won't do it.
If you believe that you would like to win, but you won't be able to, you will lose.
If you believe you will lose, you have already lost.
Because life teaches us
That success begins with the willingness to succeed.
Everything is in our minds.
Think big and your facts will grow.
Think small and you will be left behind.
Believe you can, and you will.
Everything is in your mind.
If you believe you are advanced, you really are.
Positive thoughts bring positive energy.
Only when you think positively
Can you start to change your world.
You make the change possible.
The battle of life is not won by the strongest or fastest man,
Because, sooner or later, the man who wins is the one who believes he can win.

FIG. 2. An example of narratives and images offered to the participants during the induction.

FIG. 3. Another example of narratives and images offered to the participants during the induction.

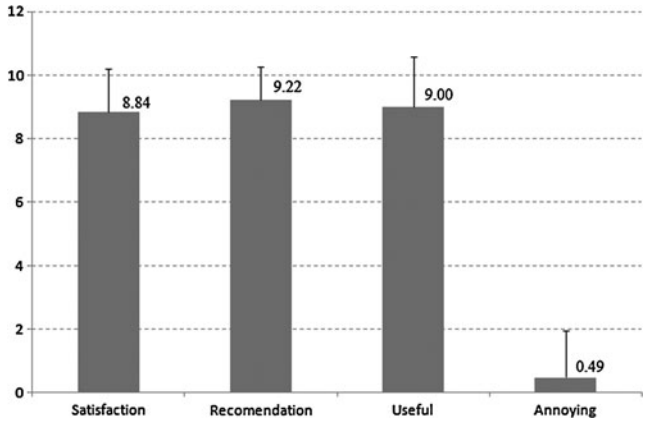

FIG. 4. Mean and standard deviation of the opinion and acceptability of the system.

In addition, we included narratives designed by a team of therapists with expertise in CBT treatment for chronic pain in order to induce motivation and positive emotions in FMS sufferers (see Table 1).

The characteristics of this VR environment allow VR sessions to be performed in a group. This is important in the case of FMS, given that group therapy is recommended for chronic pain sufferers.[33]

Procedure

Participants were recruited from the rheumatology unit of the Hospital General de Castellon. The rheumatologist gave general information about the study and referred FMS patients to LabPsitec at Jaume I University. All subjects attended voluntarily. Once the participants gave written informed consent, the SCID-I and SCID-II were administered to determine if the patients met the inclusion criteria. The group therapy sessions lasted 2 hours and were attended by six patients and two therapists in each session. After this, all participants received two sessions of psycho-education about FMS and about the activity management component. The third session included information about how to program an activity management plan and looked at choosing the activities for each patient. At the end of the third session, patients chose the activities to be performed on the following week and went through the VR component as an adjunct to increase motivation related to the performance of the chosen activities. The induction lasted approximately 20 minutes. Before and after going through the VR environment, participants filled out the outcome measures. Participants received three more therapeutic sessions to progress in the activity management program.

Results

Figure 4 displays the mean and standard deviation of the opinion and acceptability of the VR system. Results showed a high level of satisfaction with the VR ($M = 8.84$; $SD = 1.365$), and participants recommended the use of the VR to others ($M = 9.22$; $SD = 1.058$). Regarding the usefulness, participants considered the VR to be highly useful ($M = 9.00$; $SD = 1.592$). In addition, participants considered that the VR was not annoying ($M = 0.49$; $SD = 1.465$).

Table 2 summarizes the results of the *t* test for related samples and the Cohen's *d* calculated to examine the before and after induction results. Regarding pain and fatigue intensity, there was a decrement from pretest to posttest, but it was not statistically significant. However, there was a significant improvement in mood state from pre- to post-session with a moderate effect size. Regarding self-efficacy and motivation related to meaningful activities, there was a significant increase in both variables with small effect sizes. Finally, for intensity of emotions, results showed significant increases in joy, surprise, calmness, and vigor. In addition, significant decreases in sadness and anxiety were observed. The biggest effect sizes were found in calmness and joy. No differences were found in anger.

Table 3 summarizes the percentage results for the comparison questions before and after induction. The results show that 52.63% of participants felt somewhat better after induction regarding their pain, 21.05% felt the same, 15.79% felt better, and 10.52% felt much better. Only 7.5% reported

Table 2. Results of the Efficacy of the VR Induction Procedure

	n	*Pretest Mean (*SD*)*	*Posttest Mean (*SD*)*	t	p	*Cohen's* d[a]
Pain	40	5.07 (2.03)	4.82 (2.24)	1.759	0.086	0.12
Fatigue	40	4.36 (2.49)	4.18 (2.49)	0.764	0.449	0.07
Mood State	39	4.69 (1.26)	5.21 (1.17)	−4.687	0.000	−0.43
Activities						
Self-efficacy	36	4.66 (1.70)	5.11 (1.52)	−2.394	0.022	−0.30
Motivation	32	4.55 (1.65)	4.96 (1.65)	−2.652	0.012	−0.25
Emotion						
Joy	40	4.25 (1.53)	4.80 (1.44)	−3.626	0.001	−0.37
Sadness	40	2.43 (1.52)	2.07 (1.44)	2.211	0.033	0.24
Anger	39	1.44 (1.02)	1.28 (0.76)	1.030	0.310	0.18
Surprise	40	2.40 (1.82)	3.05 (2.01)	−2962	0.005	−0.34
Anxiety	39	2.26 (1.52)	2.10 (1.54)	1.098	0.279	0.10
Calmness	40	3.60 (1.95)	4.73 (1.60)	−3.984	0.000	−0.63
Vigor/Energy	40	3.73 (1.65)	4.35 (1.63)	−3.007	0.005	−0.38

[a]What Cohen (1988) defines as $d = 0.2$ are regarded as a ''small'' effect size, $d = 0.5$ as ''medium,'' and $d = 0.8$ as ''large.''

Table 3. Results in Percentage for the Comparison Questions Before and After Induction in Pain, Fatigue, Mood State, Self-Efficacy, and Motivation

	Pain	*Fatigue*	*Mood state*	*Self-efficacy*	*Motivation*
Much worse	0	0	0	2.5	2.5
Worse	0	0	0	2.5	0
Somewhat worse	7.5	2.5	0	0	2.5
Same	27.5	33.3	21.1	17.9	12.5
Somewhat better	42.5	41.7	44.7	33.3	35.9
Better	12.5	11.1	15.8	30.8	33.3
Much better	10.0	11.1	18.4	12.8	12.8

feeling a little worse. Regarding fatigue, 50% of participants felt the same, 37.5% felt somewhat better, and 12.5% felt better. Only one participant reported feeling somewhat worse. Regarding general mood state, 33.33% of participants felt somewhat better after induction, 27.78% felt the same, 27.78% felt better, and 11.11% felt much better. In the same way, 57.9% of participants felt better after induction in terms of their sense of self-efficacy regarding the activities chosen in the activity management plan, 15.79% felt the same, 15.79% felt somewhat better, and 10.52% felt much better. Only two participants reported feeling worse or much worse. With regard to motivation, 57.9% of participants felt better after induction, 21.05% felt somewhat better, 10.52% felt the same, and 10.52% felt much better. Only two participants reported feeling somewhat worse or much worse.

Discussion

This study presents data of the opinion, acceptance, and preliminary efficacy of a VR procedure for the induction of positive emotions and motivation as an adjunct to an activity management component for the psychological treatment of FMS.

Forty patients received this procedure within the content of a CBT group session. Most patients reported feeling better after going through the VR procedure and being more motivated to become involved in meaningful activities, showing that it is feasible to deliver a VR procedure for the induction of positive emotions as an adjunct to the activity management component, and it had a positive effect on patients. Furthermore, all patients highly recommend the use of VR and considered it was a useful tool in their treatment.

This is an important result, given that the chronicity of the dysfunctional behavior pattern in FMS sufferers makes the task of becoming active very challenging. The activity management component consists of setting goals related to activities that are meaningful for the patients and progressively encouraged them to perform those activities in a balanced way. Negative emotions are a barrier to achieving therapeutic goals, causing low motivation and low self-efficacy. Our VR environment was designed to promote positive emotions and motivation, and offers preliminary data on the possibility of using its positive effects in encouraging FMS sufferers to become involved in meaningful activities to improve their mood, emotional well-being, and quality of life.

This work contributes to the use of ICT and, specifically, VR in a field where research is still very scarce—chronic pain.[16] This is the first study testing a VR procedure for induction of positive emotions, and could be an important step for the improvement of psychological treatments in chronic pain patients, given the importance of positive emotions to promote significant activities as an essential component of well-being. These findings encourage us to continue with this line of research, to explore concretely the efficacy of this procedure in a controlled study in order to improve patients' quality of life.

Our work also contributes to a different way of delivering VR. We used a large screen and not a head mounted display, as it is usual in VR therapy. Our study demonstrated that it is possible to deliver a VR therapeutic component in a group setting. This is important in the case of FMS, given that group therapy is recommended for chronic pain sufferers.[33]

The main limitation of this study is that our data are from a single VR induction, without an evaluation of a long-term effect. Our main aim was to explore if it was feasible to use the VR procedure in this population. Given their dysfunctional and chronic condition, we wanted to examine if patients felt comfortable with the use of VR in a usual CBT group session. This aim was achieved in a significant number of participants, where not only was not only feasible, it also had positive effects. Further research is needed to explore the efficacy of the repeated use of this VR procedure within a CBT program. Another limitation of this study is the absence of a control group, but our aim was to develop a VR procedure designed for a specific population and test it in the context of real treatment. Our next step will consist of designing a control study in order to compare the VR procedure with other VR environments validated as mood induction procedures.

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Author Disclosure Statement

No competing financial interests exist.

References

1. Theadom A, Cropley M, Humphrey KL. Exploring the role of sleep and coping in quality of life in fibromyalgia. Journal of Psychosomatic Research 2007; 62:145–151.
2. Mease P. Fibromyalgia syndrome: review of clinical presentation, pathogenesis, outcome measures and treatment. Journal of Rheumatology 2005; 75:6–21.
3. Langley PC. The prevalence, correlates and treatment of pain in the European Union. Current Medical Research & Opinion 2011; 27:463–480.
4. Spaeth M. Epidemiology, costs, and the economic burden of fibromyalgia syndrome: efficacy of operant behavioral and cognitive behavioral treatments. Arthritis Research & Therapy 2009;11:2.

5. García-Campayo J, Magdalena J, Magallon R, et al. A meta-analysis of the efficacy of fibromyalgia treatment according to level of care. Arthritis Research & Therapy 2008; 10:15.
6. Hauser W, Bernardy K, Arnold B, et al. Efficacy of multicomponent treatment in fibromyalgia syndrome: a meta-analysis of randomized controlled clinical trials. Arthritis & Rheumatology 2009; 61:216–224.
7. Van Houdenhove B, Egle UT. Fibromyalgia: a stress disorder? Piecing the biopsychosocial puzzle together. Psychotherapy & Psychosomatics 2004; 73:267–275.
8. Glombiewski JA, Sawyer AT, Gutermann J, et al. Psychological treatments for fibromyalgia: a meta-analysis. Pain 2010; 151:280–295.
9. Powers MB, Emmelkamp P. Virtual reality exposure therapy for anxiety disorders: a meta-analysis. Journal of Anxiety Disorders 2008; 22:561–569.
10. Opris D, Pintea S, García-Palacios A, et al. Virtual reality exposure therapy in anxiety disorders: a quantitative meta-analysis. Depression & Anxiety 2012; 29:85–93.
11. Hoffman HG, Garcia-Palacios A, Patterson DR, et al. The effectiveness of virtual reality for dental pain control: a case study. CyberPsychology & Behavior 2001; 4:527–535.
12. Hoffman HG, Patterson DR, Seibel E, et al. Virtual reality pain control during burn wound debridemant in the hydrotank. Clinical Journal of Pain 2008; 24:299–304.
13. Malloy KM, Milling LS. The effectiveness of virtual reality distraction for pain reduction: a systematic review. Clinical Psychology Review 2010; 30: 1011–1018.
14. Cole J, Crowle S, Austwick G, et al. Exploratory findings with virtual reality for phantom limb pain; from stump motion to agency and analgesia. Disability & Rehabilitation 2009; 31:846–854.
15. Gaggioli A, Amoresano A, Gruppioni E, et al. A myoelectric-controlled virtual hand for the assessment and treatment of phantom limb pain in trans-radial upper extremity amputees: a research protocol. Studies in Health Technology & Informatics 2010; 154:220–222.
16. Keefe, FJ, Huling DA, Coggins MJ, et al. Virtual reality for persistent pain: a new direction for behavioral pain management. Pain 2012; 153:2163–2166.
17. Botella C, Garcia-Palacios A, Vizcaíno Y, Herrero R, Baños RM, Belmonte MA. Virtual reality in the treatment of fibromyalgia: a pilot study. Cyberpsychology, Behavior, and Social Networking 2013; 16:215–223.
18. Isen AM. (2002) a role for neuropsychology in understanding the facilitating influence of positive affect on social behavior and cognitive processes. In Snyder CR, Lopez SJ, eds. *Handbook of positive psychology*. New York: Oxford University Press, pp. 528–540.
19. Fredrickson BL. The role of positive emotion in positive psychology: the broaden and build theory of positive emotion. American Psychologist 2001; 56:218–226.
20. Catalino LI, Fredrickson BL. Tuesdays in the lives of flourishers: the role of positive emotional reactivity in optimal mental health. Emotion 2011; 11:938–950.
21. Botella C, Riva G, Gaggioli A, Wiederhold BK, Alcañiz M, Baños RM. The present and future of positive technologies. Cyberpsychology, Behavior, and Social Networking 2012; 15:78–84.
22. Herrero R, Castilla D, Vizcaíno Y, Molinari G, García-Palacio A, Botella C. Avances en el tratamiento psicológico de la fibromialgia: el uso de la realidad virtual para la inducción de emociones positivas y la promoción de la activación comportamental. Un estudio piloto. Revista Argentina de Clínica Psicológica, 2013; 22:111–120.
23. Wolfe F, Smythe H, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. Arthritis & Rheumatism 1990; 33:160–172.
24. First MB, Spitzer RL, Gibbon M, et al. (1996) *Structured clinical interview for DSM-IV axis I disorders, clinician version (SCID-I).* Washington, DC: American Psychiatric Press, Inc., 1996. (Spanish version published by Masson, 1999).
25. First MB, Gibbon M, Spitzer RL, et al. (1997) *Structured clinical interview for DSM-IV axis II personality disorders, (SCID-II).* Washington, DC: American Psychiatric Press, Inc., 1997. (Spanish version published by Masson, 1999).
26. Baños RM, Liaño V, Botella C, et al., eds. *Persuasive technology: lecture notes in computer science*. Berlin/ Heidelberg: Springer-Verlag, pp. 7–15.
27. Baños RM, Guillen V, Quero S, et al. A virtual reality system for the treatment of stress-related disorders: a preliminary analysis of efficacy compared to a standard cognitive behavioural program. International Journal of Human Computer Studies 2011; 69:602–613.
28. Bradley MM, Lang PJ. (1999) International affective digitized sounds (IADS): Stimuli, instruction manual and affective ratings. Technical report B-2. Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.
29. Yik MSM, Russell JA, Barrett LF. Structure of self-reported current affect: integration and beyond. Journal of Personality & Social Psychology 1999; 77:600–619.
30. Gabrielsson A, Lindstrom E. (2001) The influence of musical structure on emotional expression. In Juslin PN, Sloboda JA, eds. *Music and emotion: theory and research.* Oxford: Oxford University Press, pp. 223–248.
31. Rigg MG. Speed as a determiner of musical mood. Journal of Experimental Psychology 1940; 27:566–571.
32. Lang PJ, Bradley MM, Cuthbert BN. (1995) *International affective picture system (IAPS): technical manual and affective ratings.* Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.
33. Flor H, Turk DC. (2011) General principles in the treatment of chronic pain. In Flor H, Turk DC, eds. *Chronic pain. An integrated biobehavioral approach*. Seattle, WA: IASP Press. pp. 321–336.

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