

The Use of Virtual Reality in the Treatment of Eating Disorders

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Abstract. A high percentage of patients with eating disorders (ED) respond to treatments such as cognitive-behavioural therapy. However, some patients do not progress significantly with these treatments, or suffer relapses. The incorporation of new technologies may help to increase the efficacy of standard treatments. Virtual reality has been successfully used to treat body image disturbances in ED patients and seems a suitable technology for cue exposure therapy in this setting. We review the published literature and discuss the results.

Keywords. Virtual Reality, treatment, eating disorders, review.

Introduction

There are effective and well-established treatments, such as cognitive-behavioural therapy (CBT), for patients with eating disorders (ED). However, there are a percentage of patients who do not improve despite the intervention, or who suffer relapses. It is necessary to explore ways of improving these treatments with the incorporation of advanced technologies such as virtual reality (VR), the efficacy of which has been demonstrated for other disorders [1-6].

The term virtual reality refers to computer-simulated environments where the user experiences a sense of presence. Presence is defined as the sensation of “being there” that a person has on entering a virtual environment. The concept of presence is essential in this topic because VR environments are only useful for clinical psychology if they are able to produce similar responses in users to those produced in the real world. High tech devices play an important role in achieving a good sense of presence and reproducing life-like situations but there are other aspects, not related with technology that should be taken into account. Internal characteristics of the user and emotional involvement are especially relevant in clinical populations. Involvement depends mainly on the degree of emotional significance attributed to the activity. Studies have shown that for a subclinical or clinical population there is no need for high quality graphic representations on the computer to elicit a sense of presence [7, 8]. On the other hand, for a non-clinical population the realism of graphics and the degree of immersion are determinants in order to experience a sense of presence. Thus, the ability to elicit emotions seems to be a key factor in the attribution of reality and presence in virtual reality environments and, consequently, the achievement of strong emotion should be the main objective when designing a VR application intended for clinical use.

1. Method

The literature on the use of VR technology for the treatment of ED was reviewed. The PsycInfo, Medline, and PsycArticles databases were searched for the period from 1980, the decade in which the term virtual reality was coined [9], to 2012. Only studies with samples that included clinical populations (patients with anorexia nervosa, bulimia nervosa, EDNOS, or binge eating) were considered. Eight papers were selected: four case studies and four controlled studies.

2. Results

Since the late 1990s, pioneering researchers have developed VR-based software systems for ED treatment. These applications have mainly focused on body image disturbances. Body image is the mental representation of the physical appearance of one's own body. This mental representation includes perceptual, cognitive, and affective aspects, and influences the person's behaviour. It is a dynamic representation that the person builds during lifetime from their everyday experiences and in a specific socio-cultural context. Due to this complexity, most research focuses on the study of two disturbances derived from two components of body image (the perceptual and the cognitive-affective). These two disturbances are the perceptual distortion of body image and body dissatisfaction. Body image distortion refers to the inability to perceive the size of the body accurately. Body dissatisfaction refers to the degree to which a person likes or dislikes the size and shape of his/her body.

VR-based therapies are especially suitable for improving body image in ED patients. VR allows patients to create three-dimensional figures that represent their own body and which can be modified in order to reproduce different components of the body image, such as perceived or ideal body image. The use of immersive devices such as VR goggles or head-mounted displays allows participants to interact with their full-size virtual body. Furthermore, computer technology provides ED patients with therapist-independent information about their distorted body image. Finally, VR allows simulation of real-life situations related to body image concerns in which participants are exposed to situations and events that trigger their ED symptoms.

The literature shows that only eight papers including a clinical population have been published (Table 1). In these studies, VR-based exposure was administered in addition to other psychological intervention, such CBT. Results obtained in these studies showed that all treated patients improved ED symptoms, but those who were treated with the VR component showed a significantly greater improvement in body image related disturbances, specially, body image dissatisfaction. These improvements were even greater at the follow-up [18]. Despite positive results, there are several methodological drawbacks that should be taken into account: first, only four controlled studies have been published and they all used small samples; second, only two case studies and one controlled study include follow-up. Moreover, available data about the use of VR in the treatment of body image disturbances in ED come mainly from two research groups: the group of Giuseppe Riva (Milano, Italy) and the group of Perpiñá, Botella and Baños (Valencia, Spain). Consequently, although examined results suggest that the addition of a VR component improves body image in ED patients; further research using stronger methods is needed.

Table 1. Studies about the effectiveness of including VR-exposure in the treatment of ED

	Authors	Conditions	N	Outcome
Case studies	Riva, Bacchetta, Baruffi, Rinaldi, & Molinari [10, 11]*	1 VEBIM 2	1 female AN 22-year-old	Increment of body awareness. Reduction of body image dissatisfaction.
	Perpiñá, Baños, Botella, & Marco [12]	1 CBT + VR	1 ED participant	One-year follow-up data Improvement of treatment achievements during the period.
	Salorio, Gómez, Morales, Torres, Díaz, & Alegría [13]	1 CBT + VR	1 female AN	Improvement of body satisfaction. One-year follow-up data: higher body satisfaction
Controlled studies	Perpiñá, Botella, Baños, Marco, Alcañiz, & Quero [14]	2 (between subject): CBT + relaxation & CBT + VR	18 ED female.	VR condition participants showed a greater significant improvement in specific BI variables, depression and anxiety.
	Riva, Bacchetta, Baruffi, & Molinari [15]	2 (between subject): VREDIM (+ low-calorie diet and physical training) & NG (+ low-calorie diet and physical training)	20 BED female	VREDIM was more effective in improving body satisfaction, self-efficacy, and motivation for change.
	Riva, Bacchetta, Cesa, Conti, & Molinari [16]	4 (between subject): WL, NG, ECT, CBT	36 ED female	ECT was more effective than CBT in improving BI (body awareness, body satisfaction, and physical acceptance).
	Perpiñá, Marco, Botella, & Baños [17]	2 (between subject): SBIT & CBT + VR	12 ED female	The combination of CBT and VR increased the power of the results of SBIT. Results at post-treatment improved over 1 year and extended to ED and general psychopathology.

Note: AN (anorexia nervosa), BE (binge eating), BED (binge eating disorder), BI (body image), EDNOS (eating disorders not otherwise specified), CBT (cognitive-behavioural therapy), ECT (experiential cognitive therapy: based on VR), NG (Nutritional group, on cognitive-behavioural approach), SBIT (standard BI treatment), VEBIM 2 (enhanced version of VEBIM), VR (virtual reality), VREDIM (Virtual Reality for Eating Disorders Image Modification: Improved version of VEBIM), WL (waiting list)

* Both papers refer to the same study despite addressing different aspects of the case.

Studies also indicate that exposure to virtual food provokes physiological and psychological reactions in ED patients similar to those produced by exposure to real food [19-21]. These findings have led some researchers [22] to propose VR technology for cue exposure therapy in ED patients. Previous studies [23, 24] provided evidence of the effectiveness of in vivo cue exposure therapy for reducing bulimic symptoms, especially binge eating episodes. Given that VR has been successfully used for cue

exposure therapy in the treatment of addictions [22], a future step could be the application of this technology for cue exposure therapy in ED. In vivo exposure in the context of treatment presents logistical difficulties and, moreover, lacks ecological validity. VR allows simulation of real-life situations, providing an ecological, secure, flexible, and controlled environment where patients can be assessed and treated.

3. Conclusions

The studies reviewed suggest that the incorporation of VR may increase the effectiveness of standard treatments. VR-based therapies significantly improve body image disturbances in ED patients. Moreover, studies suggest that VR cue exposure therapy may be an effective procedure for reducing ED symptoms, especially binge eating episodes. VR has great potential in the treatment of ED, but further studies of its use are required.

References

- [1] S. Côté, S. Bouchard, Virtual Reality exposure's efficacy in the treatment of specific phobias: A critical review, *Journal of Cybertherapy and Rehabilitation* **1** (2008), 75–91.
- [2] J. Cukor, J. Spitalnick, J.A. Difede, A. Rizzo, B.O. Rothbaum, Emerging treatments for PTSD, *Clinical Psychology Review* **28** (2009), 715–726.
- [3] A. Gorini, G. Riva, Virtual Reality in anxiety disorders: The past and the future, *Expert Reviews Neurotherapeutics* **8** (2008), 1-19.
- [4] N.E. Maher, J.I. Gold, The use of virtual reality for pain control: A review, *Current Pain and Headache Reports* **13** (2009), 100-109.
- [5] T.D. Parsons, A.A. Rizzo, Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis, *Journal of Behavior Therapy and Experimental Psychiatry* **39** (2008), 250-261.
- [6] M.B. Powers, P.M.G. Emmelkamp, Virtual Reality exposure therapy for anxiety disorders: A meta-analysis, *Journal of Anxiety Disorders* **22** (2008), 561-569.
- [7] R.M. Baños, C. Botella, M. Alcañiz, V. Liaño, B. Guerrero, B. Rey, Immersion and emotion: Their impact on the sense of presence, *CyberPsychology & Behavior* **7** (2004), 734-741.
- [8] R.M. Baños, C. Botella, A. García-Palacios, H. Villa, C. Perpiñá, M. Alcañiz, Presence and reality judgment in virtual environments: A unitary construct? *CyberPsychology & Behavior* **3** (2000), 327-335.
- [9] T.G. Zimmerman, J. Lanier, C. Blanchard, S. Bryson, Y. Harvill. A hand gesture interface device, *ACM SIGCHI Bulletin* (1986), 189-192.
- [10] G. Riva, M. Bacchetta, M. Baruffi, S. Rinaldi, E. Molinari, Experiential cognitive therapy in anorexia nervosa, *Eating and Weight Disorders* **3** (1998), 141-150.
- [11] G. Riva, M. Bacchetta, M. Baruffi, S. Rinaldi, E. Molinari, Virtual reality based experiential cognitive treatment of anorexia nervosa, *Journal of Behavior Therapy and Experimental Psychiatry* **30** (1999), 221-230.
- [12] C. Perpiñá, R.M. Baños, C. Botella, J.H. Marco, Virtual reality as a therapy tool: A case study on body image alteration disorder, *Revista Argentina de Clínica Psicológica* **10** (2001), 227-241.
- [13] P. Salorio, R. Gómez, I. Morales, A. Torres, A. Díaz, A. Alegría, La realidad virtual, una nueva herramienta terapéutica. Tratamiento de la imagen corporal en los trastornos alimentarios, *Revista Electrónica Semestral de Enfermería* **5** (2004), retrieved from <http://revistas.um.es/eglobal/article/view/543/563>
- [14] C. Perpiñá, C. Botella, R.M. Baños, H. Marco, M. Alcañiz, S. Quero, Body image and virtual reality in eating disorders: Is exposure to virtual reality more effective than the classical body image treatment? *CyberPsychology & Behavior* **2** (1999), 149-159.
- [15] G. Riva, M. Bacchetta, M. Baruffi, E. Molinari, Virtual-reality-based multidimensional therapy for the treatment of body image disturbances in binge eating disorders: A preliminary controlled study, *IEEE*

Transactions on Information Technology in Biomedicine: A Publication of the IEEE Engineering in Medicine and Biology Society **12** (2002), 224-234.

- [16] G. Riva, M. Bacchetta, G. Cesa, S. Conti, E. Molinari, Six month follow-up of in-patient experiential-cognitive therapy for binge eating disorders, *CyberPsychology & Behavior* **6** (2003), 251-237.
- [17] C. Perpiñá, J. H. Marco, C. Botella, R.M. Baños, Tratamiento de la imagen corporal en los trastornos alimentarios mediante tratamiento cognitivo-comportamental apoyado con realidad virtual; Resultados al año de seguimiento, *Psicología Conductual: Revista Internacional de Psicología Clínica y de la Salud* **12** (2004), 519-537.
- [18] M. Ferrer-García, J. Gutiérrez-Maldonado, The use of virtual reality in the study, assessment, and treatment of body image in eating disorders and nonclinical samples: A review of the literature, *Body Image* **9** (2012), 1-11.
- [19] M. Ferrer-García, J. Gutiérrez-Maldonado, A. Caqueo-Urizar, E. Moreno, The Validity of Virtual Environments for Eliciting Emotional Responses in Patients with Eating Disorders and in Controls, *Behavior Modification* **3** (2009), 830-854.
- [20] A. Gorini, E. Griez, A. Petrova, G. Riva, Assessment of the emotional responses produced by exposure to real food, virtual food and photographs of food in patients affected by eating disorders, *Annals of General Psychiatry* **9** (2010), doi:10.1186/1744-859X-9-30.
- [21] C. Perpiñá, C. Botella, R.M. Baños, Virtual reality in eating disorders, *European Eating Disorders Review* **11** (2003), 261-278.
- [22] P.S. Bordnick, B.L. Carter; A.C. Traylor, What virtual reality research in addictions can tell us about the future of obesity assessment and treatment, *Journal of Diabetes Science and Technology* **5** (2011), 265-271.
- [23] A. Jansen, A learning model of binge eating: Cue reactivity and cue exposure, *Behaviour Research and Therapy* **36** (1998), 257-272.
- [24] E. Martínez-Mallén, J. Castro, L. Lazaro, E. Moreno, A. Morer, E. Font, J. Julien, M. Vila, J. Toro, Cue exposure in the treatment of resistant adolescent bulimia nervosa, *International Journal of Eating Disorders* **40** (2007), 596-601.