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Clinical validation of a virtual environment for normalizing eating patterns in eating disorders

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Abstract

The purpose of the present study was to examine the clinical validation of a Virtual Reality Environment (VRE) designed to normalize eating patterns in Eating Disorders (ED). The efficacy of VR in eliciting emotions, sense of presence and reality of the VRE were explored in 22 ED patients and 37 healthy eating individuals. The VRE (non-immersive) consisted of a kitchen room where participants had to eat a virtual pizza. In order to assess the sense of presence and reality produced by the VRE, participants answered seven questions with a Likert scale (0–10) during the experience, and then filled out the Reality Judgment and Presence Questionnaire (RJPQ) and ITC-Sense of Presence Inventory (ITC-SOPI). The results showed that the VRE induced a sense of presence and was felt as real for both groups, without differences in the experience of "ease" with the VRE, sense of physical space, or the ecological validity assigned to the virtual kitchen and eating virtually. However, the ED patients reported paying more attention and experiencing greater emotional involvement and dysphoria after virtual eating. The results suggest that the VRE was clinically meaningful to the ED patients and might be a relevant therapy tool for normalizing their eating patterns.

1. Introduction

1.1. Eating Disorders and disordered eating

Eating Disorders (ED) are characterized by altered eating patterns and the overvaluation of figure and weight in the self-concept. Among them, the DSM-IV-TR [1] includes Anorexia Nervosa, Bulimia Nervosa, and ED-not otherwise specified. The latter is especially important given that approximately 60% of ED outpatient cases are diagnosed in this way [2–4], with the binge-eating disorder being especially relevant considering its prevalence and relationship with obesity [5]. The course and outcome of ED can vary considerably. In some cases, the disorder only develops partially, while in others it becomes chronic and is maintained for years. Moreover, it has become increasingly important to consider ED and obesity as two poles on the same continuum of problems related to eating and weight. These two conditions include a wide variety of types of disordered eating as, without meeting all the criteria, they represent anomalous functioning patterns, including body dissatisfaction, unhealthy behaviors to lose weight, thinness or overweight, with alarming epidemiological figures. Screening studies in the USA have estimated that 25% of girls and 11% of boys present a disordered eating pattern with a degree of severity requiring a posterior clinical assessment [6].

The most widely-accepted form of psychotherapy for treating ED, mainly bulimia nervosa and binge eating disorder, is cognitive behavior therapy (CBT). CBT trains patients to change their patterns of thinking and action to prepare them to face their fears [7]. However, despite the progress made, the severity, chronicity and complications with obesity problems observed in these disorders demonstrate a lack of treatments completely capable of addressing

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their complexity [5,8]. Currently available treatments have the main objective of stabilizing eating patterns in order to achieve weight regulation, but these therapeutic strategies must be optimized [9].

1.2. Virtual Reality as a clinical tool

Currently, a great expansion is occurring in computational technologies and, specifically, Virtual Reality (VR) technologies, in many healthcare areas. VR techniques have been shown to be effective as therapeutic tools in treating various psychological disorders and problems, changes in habits, and rehabilitation, with noteworthy success [10–13]. In the last 15 years, interest in exposure techniques designed and developed in VR has increased; therefore, clinicians have created virtual environments that allow patients to confront their fears [14]. Unlike exposure using the imagination, patients are engaged by several of their senses, heightening the realism of the context. Unlike exposure "in vivo", patients are in a safe, confidential place with the therapist in complete control [15]. Finally, it is much more difficult to control the variables in real-life situations than in VR environments.

VR was first used in the ED field in the treatment of body image alterations in a group of subclinical participants worried about food and physical appearance [16]. Later, a controlled study developed a CBT treatment supported by VR techniques for body image disturbances, and applied it to a sample of ED patients [1–18]. Results showed that patients treated in the CBT plus VR condition showed significantly greater improvement, not only in body image, but also on psychopathology-related indices, with further improvements after one year.

The use of VR has also extended to other alterations in eating behavior, obtaining similar results when applying cognitive therapy combined with VR in treating body image disturbances in patients with binge-eating disorder and obesity [18–20].

Another necessary treatment element, both in ED and obesity, is eating pattern normalization. Patients with ED show anxiety when eating high-calorie food and in situations where their body is displayed or they come into contact with other people [21]. These cues related to food aversion (specifically high-calorie food) are included in most ED assessment instruments and therapy programs [22].

Considering the advantages and challenges VR presents as a therapeutic tool, it is logical to propose that VR can help to deal with aspects of eating that are difficult to include in therapeutic sessions, such as exposure to food or eating certain "forbidden" foods by the patients [23]. In recent years, studies have shown that exposure to virtual food produces the same sensations as exposure to real food, using both non-immersive [24] and immersive environments [25].

1.3. Current study

Until now, VR applications in disordered eating behavior have basically focused on body image intervention, addressing the topic of eating and disordered eating habits tangentially. However, this technology may help to improve aspects of the behavioral–cognitive strategies in the normalization of eating and regulating the urge to eat.

The main purpose of this study was to carry out the clinical validation of VR software about environments involving food and eating for use in normalizing the eating behavior of ED patients and people with disordered eating. To this aim, differences in the VR experiences (in this case, non-immersive) of ED patients and non-clinical individuals were analyzed. We hypothesize that ED patients experience VR environments related to food and eating with more discomfort, fear and avoidance than non clinical participants, since these elements are emotionally and clinically significant to the patients' problem.

2. Method

2.1. Participants

The Clinical Group (CG) consisted of 22 females with an ED diagnosis [11 Anorexia nervosa (AN), 4 Bulimia nervosa (BN), 7 Not otherwise specified ED (EDNOS)], according to DSM-IV-TR criteria (APA, 2002), recruited from the psychiatric Departments of Dr. Peset Hospital and Bellvitge University Hospital (Spain). The mean age of the clinical group was 24.50 years (SD = 7.92), with a mean Body Mass Index (BMI) of 19.93 (SD = 4.13; range: 16.03–29.35). The majority were single (68.2%) with a medium socio-economic level (68.2%) and secondary studies (77.3%).

The Healthy Comparison (HC) group consisted of 37 female psychology students in their last year at the University of Valencia. The mean age of this group was 24.24 years (SD = 6.53), with BMI = 21.64 (SD = 3.02; range: 18.12–27.73). The majority were single (86.5%) with a medium socio-economic level (78.4%).

2.2. Software and hardware

The virtual environment consisted of a kitchen with two main areas. The first is the prep area, with a countertop, cabinets, burners and a fridge that contains all of the elements necessary to prepare a meal, serve it and then eat it "virtually." When the food is eaten, it is accompanied by the sound of chewing and the portions of food on screen gradually disappear. The foods are located in the fridge, cabinets and shelves, which the user can access freely or block if desired. The second kitchen area is mainly for eating foods the right way: there are a table and a chair for the patient to sit along with all the necessary items for a meal (dishes, a glass, silverware, a napkin). The eating style can be set to fast or slow. The size of certain foods can be increased or decreased (chocolate, potatoes, pizza, etc.) so that they take up the whole screen (i.e. the kitchen) or get so small that they disappear. There is also an option for alternative behaviors (making a phone call or turning on the radio) in