

Monographic Article
Normalization of the eating patterns in a patient with anorexia nervosa, purgative subtype, with the support of a virtual environment. A case study

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Summary:

The aim of this study was to analyze the usefulness and effectiveness of a virtual environment as a complementary tool to cognitive-behavioral treatment in normalizing the food intake of a patient with a diagnosis of AN, purging subtype.

After the 6-session VR module, the results indicated that the patient was normalizing her eating patterns. Her bingeing and vomiting had decreased; she had introduced forbidden foods avoided for years like toast and pizza, and her weight had increased slightly. There was also an improvement in all factors assessed by the EDI, highlighting a major change in “perfectionism” and “drive to thinness”. Her depressive and anxious symptoms had decreased, and her social interaction had increased progressively. Virtual experiences were evaluated as very real by the patient, who felt quite involved with the virtual environment. The level of satisfaction and degree of usefulness of the VR component were rated highly by the patient. Finally, the need to explore new therapeutic strategies in order to increase adherence and motivation in these kinds of patients and disorders is discussed.

Keywords: Eating Disorders, Anorexia, purgative subtype; Virtual Reality, Efficiency

Received: 27/03/2012 Accepted: 09/05/2012

INTRODUCTION

Virtual Reality (VR) is a computer tool that allows the user (in our field, the patient) to experience a virtual but clinically significant situation applicable to his/her disorder within a safe environment and under the supervision of a therapist. This tool, which is considered a step prior to real or in vivo exposure (Riva, 2009), can be customized and adapted to the needs of each patient. In addition, virtual environments are less likely than treatments such as exposure therapy to affect or cause patients to reject their doctor's orders, as has been noted in the use of VR for patients suffering from anxiety disorders (Olatunji, Cisler and Deacon, 2010).

VR has proven a useful, efficient tool in the study and treatment of different aspects of eating disorders (ED). The first studies to analyze the effects and usefulness of virtual environments in helping patients suffering from these disorders focused on the evaluation and treatment of altered body image (Perpiñá et al., 1999; Perpiñá, Marco, Botella and Baños, 2004; Riva, Bacchetta, Baruffi, Rinaldi and Molinari, 1999; Riva et al., 2000). These studies, in which the virtual application was a component specifically designed for the treatment of an altered body image, showed the tool's effectiveness in addressing this disorder. In addition, the tool was shown to

successfully reduce eating disorder symptoms and the associated psychopathology while achieving higher treatment compliance rates and increasing patient motivation in the treatment process (Perpiñá et al., 2004).

Another indispensable element in the treatment of both EDs and obesity is the normalization of eating patterns. In terms of the advantages and challenges that VR presents as a therapeutic tool, it is logical to ask whether this tool can help patients approach aspects of eating that are not easily accessible in therapy or other issues difficult to address both in therapy sessions and beyond. This is the case of food exposure and of eating certain foods “forbidden” by the patients.

In the past few years, studies have shown that the exposure to virtual food produces the same feelings as the exposure to real food (Ferrer-Garcia, Gutierrez-Maldonado, Caqueo-Urizar and Moreno, 2009; Gorini, Griez, Petrova and Riva, 2010). Specifically, in order to stabilize eating patterns in the case of patients suffering from obesity and/or EDs, another virtual environment is being tested. This non-immersive environment consists of a virtual kitchen where foods with different calorie counts are stored either in the refrigerator or cabinets (Perpiñá et al., 2009). The foods are arranged so that they can be stored, cooked and then eaten. The kitchen has a table where the food is served and then eaten while following certain guidelines (eat slowly, savor the food, etc.). The program is still in the stage of experimentation and validation, but the preliminary results with respect to the emotional impact of both controls and patients have been highly satisfactory (Perpiñá et al., 2010). This same virtual environment has been re-

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cently used as part of virtual food exposure for a patient with restrictive anorexia nervosa (AN), a type highly resistant to treatment (Cardi et al., 2012). After the virtual exposure to foods and after eating “virtually”, the patient displayed less anxiety, a diminished fear of food and fewer safety-seeking behaviors; the food-related symptoms were reduced and the patient’s Body Mass Index (BMI) increased.

People with AN avoid food, which they associate with negative emotions, thoughts and images. Patients are also characterized by poor insight and little motivation to change, combined with a high rate of abandoning treatment. For all these reasons, the therapist is up against one of the most difficult mental disorders to treat and patients with whom it is hardest to reach therapeutic alliance (Casanovas et al., 2007; Treasure and Ward, 1997). Based on the results of different studies, new research into VR should be done since this technology allows patients to confront their fears, overcome their difficulties and to accept situations that may not have even occurred to them in real life.

The purpose of this study was to analyze the usefulness and effectiveness of a virtual environment as a complementary tool in cognitive-behavioral treatment to normalize the eating patterns of a patient diagnosed with purgative AN.

METHOD

Patient Data

N. is a female age 21, single, with a medium socioeconomic status. At the time of the consultation, she was living in a student apartment in the Valencian Community, where she was studying at the university.

Chief Complaint

In the first interview, the patient’s BMI was 17.40. The patient opted for treatment on her own because she acknowledged that the problem was interfering in her relationships with others and affecting her academic performance. She had severe dietary restraint one or two meals per day consisting of coffee with milk, vegetables and/or fruit) along with daily bingeing episodes (abundant quantities of high-calorie foods following by an overwhelming sensation of having lost control) following by self-induced vomiting. She admitted feeling very ashamed of her episodes of bingeing-purging and expressed an intense fear of gaining weight. She presented a distorted body image; a fear of getting fat; mistaken and dysfunctional beliefs regarding weight maintenance and nutrition in general, and a constant concern regarding eating, weight and her figure.

Due to her eating disorder, the patient presented the following physical effects: amenorrhea for the past six months,

constipation, hypothermia, sensitive teeth, back pain, stomach pain and discomfort, heartburn, brittle fingernails, hair loss, exhaustion and sleeping problems. She did not present Russell’s sign or swelling of the parotid glands. In the physical examination, her cell blood count, biochemical analysis and TSH were normal. In the cognitive examination, she exhibited reduced concentration, attention and memory; a downturn in her academic performance and self-esteem and an exacerbation of her premonitory obsessive symptoms. In the emotional sphere, she had symptoms of both depression and anxiety. Finally, in terms of her social interactions, she reported a deterioration in her personal relationship and a tendency to isolate herself.

History of the problem

At the age of 12, she began a restrictive diet during summer in order to lose weight. She soon became very concerned about her weight and about food, dropping to 37kg at that time. After returning to her regular weight, at the age of 14 she relapsed into her food restriction patterns once again, though this time accompanied by weekly vomiting episodes. When she started high school, her eating patterns and weight stabilized. From ages 17 to 19, she resorted to vomiting sporadically to alleviate stress and dysphoria, both of which were probably caused by the demands of that particular moment in her life (the pressure to choose a career; questioning her own identity; exam week at the university, etc.).

During her second year at college, the problem became more severe (which coincided with a break-up after a three-year relationship and the stress of final exams). It got to a point where she suffered three bingeing episodes a day. She visited her primary care physician after spotting blood in her vomit. This doctor referred her to an endocrinologist and to the Mental Healthcare Unit. After seeing a psychiatrist and receiving a prescription for Cipralext and Orfidal, she was referred to Clinical Psychology. None of her family members was aware of the problem.

Description of Treatment

As part of the multidisciplinary approach, the patient received cognitive-behavioral therapy for her disorder on an outpatient basis.

The treatment goals for the medium and long term were the following: the normalization of the patient’s eating patterns and recovery of a healthy body weight; the elimination of potentially dangerous behaviors such as dietary restraint, bingeing and vomiting; greater satisfaction with her body image; reduced symptoms of anxiety and depression, and the recovery of her premonitory interpersonal functioning.

The initial therapy objectives were to increase N.’s motivation for therapy and her ability to talk about her disorder with

those close to her in order to ensure their collaboration in her psychical and psychological recovery; to educate the patient and her family members about healthy eating patterns; to provide the patient with strategies to understand and modify her dysfunctional behaviors, cognitions and emotions; to address the emotional problems associated with her disorder; and to train N. in coping strategies in order to prevent potential relapses in the future.

In order to achieve these goals, the following techniques were used: motivational techniques from Motivational Interviewing, which was developed for the psychotherapeutic treatment of addictions (Miller and Rollnick, 2002); psychoeducation about healthy eating habits and weight and to help her understand and handle the disorder; behavioral strategies in order to reduce high-risk behaviors and increase healthy behaviors; cognitive techniques for changing the patient's thinking and attitudes towards her weight and figure; problem-solving techniques and relapse prevention.

The Virtual Reality Component

Software: VR Environment

The virtual reality environment consists 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 is 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 order for the patient to distract him/herself from the impulse to eat. In addition, the software allows therapists to help their patients to address negative thoughts, think positive thoughts and training in positive self-instructions. Finally, the software provides visuals of the positive or negative consequences of the decision and behavior that the patient has just displayed (an image of body organs depicted as happy or sad).

The technical software requirements were a PC Pentium V, 2-D mouse and a 19" monitor. The patient sat in front of the monitor accompanied by her therapist in a dimly lit room that helped to create a greater sense of immersion in the virtual environment.

Therapeutic Process

In addition to the cognitive-behavioral treatment, the patient attended six VR sessions that began a month and a half after the start of her outpatient treatment. The objectives of this therapeutic tool were to help her establish healthy eating habits; to provide her with progressive exposure to certain forbidden foods; to assist her in changing her dysfunctional thoughts related to food and weight, and to train her in strategies that would help her avoid losing control while eating and thus keep her from bingeing and vomiting.

Each session lasted for 60 minutes and in all sessions there was a focus on aspects such as the appeal, fear and avoidance of "forbidden" foods as well as the patient's ability to control her impulse when exposed to these foods. After virtually eating the forbidden food, she was asked to discuss her emotions, the degree of reality she experienced during the session and any similarities with her usual experiences with food. In addition, her intrusive thoughts related to eating were explored in each session and she was encouraged to abandon these thoughts for other more adaptive ones. Each session is described in detail below.

Session 1.The main objective of this session was to reinforce the healthy eating habits introduced in the cognitive-behavioral treatment sessions. In this session, the goal was to highlight the importance of establishing a few healthy eating habits: always eat in the same place; eliminate distractions while eating; pay attention to the flavor, smell and texture of the food, and put away packages or bags after serving in order to reduce the temptation to continue eating and binge. After emphasizing these aspects and highlighting the importance of eating five meals a day, N. was invited to virtually eat the foods on the menu she had chosen (a chicken breast with salad and an apple for dessert). The program was also used to remind N. of the importance of eating slowing and positive reinforcement was provided through an onscreen image of healthy internal organs as she ate.

Session 2.To continue to work towards the normalization of healthy eating habits, this session focused on the importance of planning meals and controlling stimuli (serve food on dishes and put away food packages) in order to avoid bingeing caused by hunger and emotional eating. This session also addressed gaining the power and control that her self-forbidden foods exercised over her, and efforts to achieve greater self-control through progressive exposure to each of these foods and/or through the right internal dialogue. The patient verbalized the negative thoughts that facilitated loss of control when eating ("I shouldn't eat this because it's so fattening,") as well as positive self-instructions to help her gain power over these negative thoughts ("If I binge now, I will binge again tomorrow and I'll be right back to square one," or "My body needs energy to study and this food is part of the nutritional pyramid,").

Session 3. In order to begin progressive exposure to forbidden foods, the patient was asked to rank foods from least difficult to most difficult. To do the ranking, N. had to assess the level of appeal, urge and prohibition of each food the therapist indicated on a long list and she was then encouraged to expose herself to one of them, starting with a food ranked as moderately difficult. Throughout the narrative, the therapist reiterated all of the previous training while emphasizing the importance of introducing a given food into the patient's real-life eating habits in a healthy, moderate way.

Session 4. This session continued with progressive exposure to forbidden foods and added training on behaviors other than bingeing as ways to overcome impulsive behaviors and out-of-control eating. N. chose a new forbidden food with a higher level of difficulty and she was encouraged to eat it virtually while verbalizing her emotions and negative thoughts related to the experience. After the exposure and with the goal of avoiding the urge to continue eating, certain alternative behaviors were practiced in the program, such as making a phone call to a friend or relative. The patient was taught about the hunger mechanism and the advisability of waiting five minutes before continuing to eat. N. added her own alternative behaviors to this strategy such as drinking a cup of tea or reading a book.

Session 5. Through a hypothetical interpersonal event (an argument) or a functional event (exam week) that often led N. into an episode of emotional eating, the patient was confronted with her own urge to lose control when confronted with a forbidden food. The main objective of this session was to continue practicing the self-control strategies learned in the previous sessions: positive verbalizations and alternative behaviors such as making a phone call.

Session 6. In this session, the patient reviewed the situations she experienced in the previous sessions and highlighted the most important aspects: healthy eating habits, positive verbalizations, progressive exposure to forbidden foods and alternative behaviors to avoid the urge to continue eating and consume more than her body needs.

Measures

Beck Depression Inventory-II (BDI-II; Beck, Steer and Brown, 1996; Spanish language version: Sanz, Perdigón and Vázquez; 2003-*Inventario de Depresión de Beck*). A self-report inventory that assesses the presence and severity of symptoms of depression. It is comprised of 21 questions with 4 answer choices (from 0 to 3).

Beck Anxiety Inventory (BAI; Beck and Steer, 1993; Spanish language version: Comeche, Díaz and Vallejo; 1995-*Inventario de Ansiedad de Beck*). This inventory evaluates somatic anxiety symptoms for both anxiety disorders as well as depressive disorders. It has 21 questions that are answered using a 4-point Likert scale (from 0 to 3).

Eating Disorders Inventory-2 (EDI-2; Garner, 1991; Spanish language version: Corral, González, Pereña and Seisedos, 1998). This inventory is comprised of 91 items and uses a 6-point Likert-type answer scale (from 0=Never to 5=Always). The items are grouped into 11 sub-scales that evaluate attitudes, behaviors and more general aspects associated with DT: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation and social insecurity.

Intra-session Questionnaire: An ad hoc questionnaire designed to assess the emotions (well-being, nervousness, guilt and discomfort) associated with eating foods in VR during the session as well as the urge to throw up, fear and the need or desire to avoid food. It also included two questions on the patient's presence and perception of reality during the sessions. Answer scale from 1 "None" to 10 "A lot".

Analogous Visual Scale: An ad hoc questionnaire designed to assess the experience with the VR component, including satisfaction with treatment, usefulness of treatment and willingness to recommend the treatment to a friend or acquaintance with the same problem. Answer scale from 1 "None" to 10 "A lot".

RESULTS

Over the course of the VR sessions, the patient displayed an increase in well-being and a reduction of the negative emotions experienced when exposed to forbidden foods, in spite of the fact that the foods displayed in the sessions got progressively more difficult. In addition, according to N.'s own assessment, her urge to vomit and her fear and need to avoid these foods diminished from the first exposure session through the last session (see Table 1 and Figure 1).

With respect to her experience with VR, N. expressed that the VR practice sessions left her feeling motivated and confident. Table 1 shows that she gave a high score when asked how similar the VR session was to reality and experienced a feeling of involvement in the virtual environment.

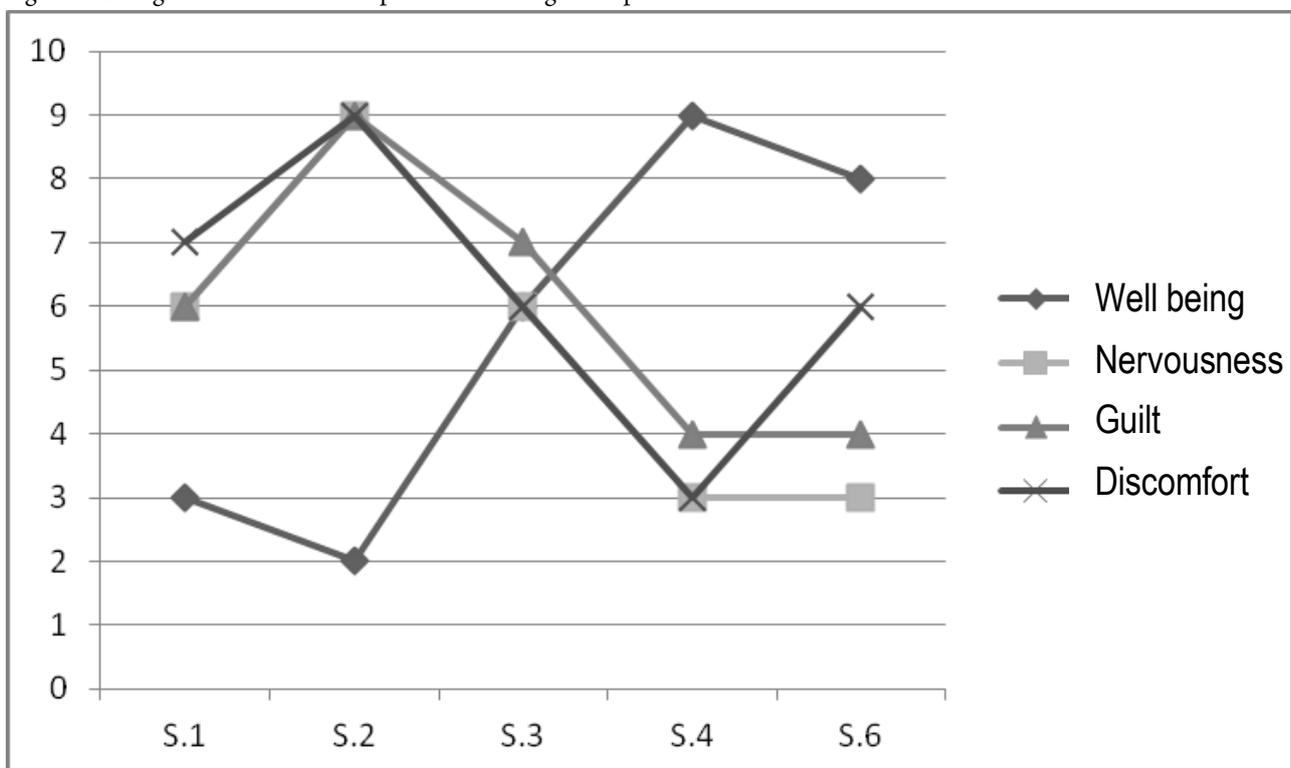
When comparing the pre and post-scores of the eating-related symptoms evaluated with the EDI-2, there was a slight improvement in all of the factors, with a greater difference in maturity fears, perfectionism and drive to thinness. However, there was no change in interpersonal distrust and a slight rise in social insecurity (probably owed to the fact that during treatment, the patient began to participate in social interactions that she had previously been avoiding). In addition, in depression and anxiety symptoms, she displayed a notable decrease at the end of the six VR sessions (see Table 2). Finally, she experienced slight weight gain, from 46.90 kg. before starting the VR sessions to 47.60 kg. when the VR component

Table 1. Urge to purge. Fear/avoidance of eating. Reality of the experience.

	Session 1	Session 2	Session 3	Session 4	Session 5	Sesión 6
Urge to purge	7	9	4	2	--	4
Fear	8	8	10	2		2
Avoidance	10	10	10	4		0
Situation similar to what usually occurs	9	9	7	9	8	8
Reality of the experience	7	9	8	9	8	8

Session 1: Chicken, salad, apple; Session 2: Croissant; Session 3: ¼ pizza; Session 4: Toast and jelly; Session 6: Sardine sandwiches

Figure 1. Changes in the emotions experienced during the exposure to virtual foods to eat over the course of the sessions.



. Vertical axis: 0= None - 10=A lot; Horizontal: S.1: Session 1; S.2: Session 2; S.3: Session 3; S.4: Session 4; S.6: Session 6. ended (see Table 2 for pre and post BMI).

N. gradually normalized her eating patterns. Her bingeing and vomiting were significantly reduced as a result of the VR component; she went from have several bingeing episodes accompanied by vomiting each day to one per week (see Table 2). She added forbidden foods she had been avoiding for years such as toast and pizza to her regular diet. In addition, her social interaction level increased progressively.

At the qualitative level, we also observed that the patient had interiorized important aspects of the program by verbalizing positive affirmations during the last session: “I’m not going to eat this today because I wasn’t planning on it, but I will eat it in the weeks to come”; “I have a craving for this but the fact is I’m not actually hungry”; “If I compromise today, I will surely compromise tomorrow as well”; “My problem doesn’t control me, I control my problem”; “It’s healthy and it’s on the nutritional

pyramid”; “To study, my body needs energy.” The sessions were also a good place for the patient to come up with her own alternative behaviors, ones that had not come up in conventional one-on-one therapy: reading a book, working on the computer, going to visit her aunt, going out for a walk, going shopping or listening to relaxing music.

The virtual experiences were evaluated as highly real by the patient. N. expressed a high level of satisfaction with the VR component and with its perceived usefulness (8 out of 10 in both cases) and she said she would recommend the program to a friend with the same problem (9 out of 10).

DISCUSSION AND CONCLUSIONS

The objective of this study was to analyze the benefits of adding a VR component to normalize eating patterns as part

Table 2. Pre-Post Data of VR sessions

	PRE	POST
EDI.2		
Drive for thinness (DT)	18	13
Bulimia	19	13
Body dissatisfaction	18	16
Ineffectiveness	7	4
Perfectionism	15	8
Interpersonal distrust	5	5
Interceptive awareness	7	9
Maturity fears	13	6
Asceticism	11	7
Impulsividad	17	14
Impulse Regulation	5	8
BDI	40	19
BAI	22	10
# binges and vomiting	2/3 times per day	1 once a week
BMI	17,43	17,70

EDI.2: Eating Disorder Inventory; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; BMI: Body Mass Index.

of general cognitive-behavioral treatment in a patient with AN, purgative subtype.

The preliminary results indicate that the VR component helped the patient to reduce her fear and avoidance of food while helping her to eat and develop more normal eating patterns.

Over the course of the VR sessions, N. showed visible progress. The patient's eating patterns normalized in comparison to the baseline levels and she became capable of increasing her range of allowed foods and introducing some of these foods into her daily diet. Her urge to binge diminished along with the presence of compensatory behaviors and the number of binging and vomiting episodes. At the same time, she began working to handle her emotions in a better way in order to avoid emotional eating.

One especially relevant aspect is that the VR exposure allowed the patient to explore in situ the emotions, feelings and thoughts that she experienced while "eating" a virtual food. This allowed the patient to pinpoint and discuss in therapy the emotions and thoughts as they occurred to her and to practice treatment techniques in an "ecological" environment, one that was clinically significant but also safe. According to the patient's own account, the vivid memories of the VR sessions helped her in real situations, allowing her to put the different strategies into practice in a more effective way.

On the other hand, VR has a positive effect on the perceived self-effectiveness and motivation to change (Riva et al., 1999),

which is critical to the treatment of any mental disorder and especially relevant in the case of ED, where patients are often hesitant about treatment and a high percentage abandon treatment altogether. In the case of this patient, the use of VR allowed her to virtually expose herself to situations she had never even imagined and to put into practice what had been recommended in therapy, reducing her fears and increasing her sense of self-effectiveness. As a result, the VR component has effectively functioned as a prior step to exposure in the real world. In the case of ED treatment, VR has a high potential to become the intermediate step between what happens in the doctor's office and what happens in reality. It is not far-fetched for patients to be able to add foods that they had not allowed themselves to have for years after virtually "eating" a piece of virtual pizza and having discussed this with their therapist (Perpiñá, Botella and Baños, 2003). As when VR is applied to other mental disorders, researchers have noted that by creating a sense of presence and reality among patients in virtual environments, these same elements help patients to apply what they've experienced in real life (Botella et al., 2004).

The results obtained in this study have been very similar to those found for a patient with restrictive AN using the same software (Cardi et al., 2012). In both cases, the VR component helped the patients to normalize their eating pattern with the resulting improvement in their BMI and in their eating and emotional symptoms. Although these results are still preliminary, they indicate that the virtual environment has been capable of mobilizing both restrictive and constructive aspects in therapy, as well as the impulsive and purgative aspects of the disorder.

Unlike the study by Gorini and colleagues (2010), who showed that the emotional impact of viewing virtual food was higher than that of photographed food, the software of this study was not immersive, that is, a VR helmet was not used to immerse the patient in a 3-D environment. As described above, the setting for the VR sessions was a dimly lit room with a relatively large screen to facilitate immersion but the VR helmet was not used. The patient's reactions and opinions of the virtual environment, however, showed that the situation seemed real enough to the patient and similar to her daily experiences. As found in another study (Perpiñá et al., 2003), for someone with these specific difficulties, the virtual environment and the possibility of interacting with the virtual environment and food are clinically significant because they allow other mechanisms—more psychological than technical—to take over. As a result, patients can allow themselves to "get involved" in the reality and setting that are established in the VR experience.

The advance of new therapeutic strategies that increase treatment adherence and the motivation to change in the case of EDs is another important topic. In its 1995 clinical guide, the APA distinguished between the effectiveness of an intervention and its clinical effectiveness or usefulness. The first generation of VR studies was aimed at demonstrating the effective-

ness of this tool in therapeutic interventions (Bush, 2008) but now that its effectiveness has been shown, the question of its efficiency has also appeared. This includes the degree to which patients accept the treatment and the question as to whether VR contributes any additional advantages to the existing techniques. EDs are highly dysfunctional syndromes that involve severe damage for the person and his or her environment; therefore, the more tools we have to help patients recover, the more strategies we will have at our disposal to deal with these difficult disorders.

This research involved just one case study and this is clearly its greatest limitation. However, the results of this and other similar studies are accruing experience and evidence of how a therapeutic assistance tool can contribute to the general treatment of EDs, which have their own specific treatment difficulties. This study has included VR as a complementary tool to traditional cognitive-behavioral therapy. VR was used to rehearse gradual exposure techniques, control of stimuli and training in alternative behaviors, thus permitting the therapist to directly supervise the patient during the session. In addition, VR allowed for things that couldn't actually happen (i.e. making a food increase in size to symbolize its power over the patient), allowing the patient to confront her fear of not being able to control her urge to eat.

In the future, studies should continue exploring this strategy as a supplement to regular psychotherapeutic intervention and as a way of exposing patients to the situations that cause them the greatest fear and emotional upset in a controlled environment.

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ACKNOWLEDGEMENTS:

This work has been funded in part by the Consellería de Sanidad (Health Council) of Valencia, Spain (SMI 3/2008), whose head researcher is C. Perpiñá.

CIBEROBN (Centro de Investigación Biomédica en Red Fisiopatología de la Obesidad y Nutrición) is an ISCIII initiative.