VR Cue-Exposure Treatment For Bulimia Nervosa

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Abstract. Several approaches to the treatment of bulimia nervosa have proved effective, including cognitive–behavioral therapy; however, not all patients improve. It is therefore necessary to explore the possibilities of increasing the efficacy of such treatments. One way to attempt this is to incorporate new technologies. This review explores the possibility of developing a new, empirically validated procedure for the treatment of bulimia nervosa patients that involves cue exposure via virtual reality.

Keywords. Virtual reality, cue exposure, treatment, binge eating, bulimia nervosa

Problem

Several treatment approaches have proved effective in the treatment of bulimia nervosa (BN); cognitive–behavioral therapy (CBT) produces the best outcomes [1, 2, 3]. However, some BN patients show resistance to conventional treatment and do not improve despite intervention. Therefore, it is necessary to explore whether the incorporation of techniques based on new technologies may enhance the efficacy of current treatment. Our aim is to develop a new treatment method based on cue exposure via virtual reality (VR). The novelty of this proposal is the addition of VR to cue-exposure procedures, which have proved effective in other studies. This addition is aimed at increasing the efficacy of cue-exposure therapy through enhancing ecological validity, while decreasing the logistic complications associated with exposure to real cues (food). The objective of this study is to review the literature on the use of cue exposure with response prevention of bingeing in the treatment of BN, and to discuss the use of VR as the exposure method.

1. Method

The literature on the use of cue-exposure treatment for binge eating in BN is reviewed. The PsycInfo, Medline, and PsycArticles databases were searched by entering the following terms and Boolean operator: *cue exposure* and *binge eating*. Inclusion criteria were broad and no period, language or document type restrictions were considered.

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2. Results

We selected 25 papers from those identified in the searches. Two types of BN treatment based on cue exposure with response prevention were found: exposure with response prevention of purging (ERP-P) and exposure with response prevention of bingeing (ERP-B). Only six studies focused on the assessment of ERP-B: one case study [4], four case series [5-8], and a non-randomized controlled trial [9]. A crossover study comparing ERP-B and ERP-P [10] was also found.

In 1988, Schmidt and Marks [5] first reported results obtained from the treatment of four patients with BN by ERP-B. In that study, patients were exposed to their preferred binge-inducing food. They were asked to eat a small amount of it and they were also encouraged to smell and touch it, in order to trigger an urge to binge; which they then had to resist. Two patients reduced their bingeing and vomiting behavior and also showed improvements in mood and dietary restraint; while one dropped out of the treatment and one did not show improvement during treatment but did it at the follow-up. One year later, these authors conducted a crossover study where two groups of BN patients underwent six sessions of ERP-B and six sessions of ERP-P [10]. After a period of 3 weeks, they were crossed over to six sessions of the other treatment. The authors found that both treatments were reasonably effective at reducing binge-vomiting episodes, but they also found high drop-out rates; particularly during the ERP-B phases. They reported that, compared with ERP-P, ERP-B was less time-consuming and led to greater reductions of urges to binge, anxiety, and liking of food. The same year, Jansen and colleagues [4] reported the case of a patient with BN who was effectively treated by cue exposure plus prevention of bingeing. Food craving declined both during and between cue-exposure sessions, and the frequency of binges reduced radically. These positive results persisted during a 9-month follow-up period. The same research group conducted another study that compared the effectiveness of cue exposure and learning self-control techniques for BN treatment [9]. Both the treatments were successful in reducing craving, depression, and irrational beliefs during and between sessions. However, cue exposure was more effective in the reduction of binge eating frequency; while 100% of the patients treated by cue exposure were abstinent after treatment and during the 1-year follow-up period, only 33% of patients treated by self-control techniques remained abstinent during the follow-up. Jansen and colleagues [9] attribute their better results, compared with those of Schmidts and Marks [5, 10], to the fact that the first group conducted the cue-exposure therapy in the real binge environment of each patient, while the second group conducted it in the therapist's office. In 1995, Kennedy et al. [6] again assessed ERP-B in 20 females with BN and the anorexia bulimia subtype (AN-B). The authors found a significant within-session and pre–post treatment reduction of the urge of binge, a lack of control, feelings of guilt and tension.

The rationale behind the use of cue exposure in these studies is derived from the similarities identified between bulimia nervosa and drug addiction. Both disorders are characterized by substance craving, lack of intake control, and a high relapse rate [4]. Therefore, cue exposure, which has proved to be an effective treatment in addictive disorders, may also be effective for BN. Jansen [4, 9, 11] proposed a model based on the principles of classical conditioning to explain binge behavior present in BN patients. In that model, the intake of binge food is considered the unconditioned stimulus (US) and all the stimuli associated with this binge behavior, the conditioned stimuli (CSs). Exposure to CSs elicits physiological responses, which are subjectively experienced as

food craving, and leads to excessive food intake. In 1994, Jansen [12] postulated that there is a conditioned response (hyperinsulinemia) to food cues that, in turn, elicits a conditioned compensatory response (hypoglycemia). The action of these biochemical responses would explain the experience of craving during food exposure. Thus, the main objective of cue-exposure therapy would be to extinguish food craving by means of breaking the bond between the CSs and the US.

More recent research suggests that the reward associated with food acts on neural circuits in a similar way to the reward associated with drugs, which would explain the addictive nature of food for some people [13]. Besides their primary reinforcing properties, both food and drug intake establish strong Pavlovian associations with stimuli that predict consumption [13, 14]. Those stimuli elicit craving, and recent studies indicate that the search for cue-induced drugs or food have the same neurochemical and neuroanatomical basis [15]. Other studies conducted on animals show that there are individual differences in the intensity of the control exerted by Pavlovian cues over reward-seeking behavior, regardless of the type of reward [16]. There are animals whose behavior is intensively influenced by cues, and such individuals also exist in our species. This means that people with a phenotype that is highly reactive to reward cues may be at increased risk of addictive disorders or at increased risk of relapse after treatment. At the same time, there is general agreement that anxiety, negative moods and subjective distress can trigger episodes of binge eating [17]. Stimuli likely to trigger a binge can cause the anxiety linked to hunger experienced during the bulimic episode.

Eight years after the earliest studies, Toro and colleagues [7] resumed the study of ERP-B. Six severe BN patients, who had shown resistant to drug and cognitive–behavioral treatment, were treated by means of cue-exposure therapy. The patients were asked to touch, smell, look at, and handled food, but they could not eat it. The exposure sessions were conducted in the therapist's office. Subjective anxiety and physiological responses, such as increased blood pressure and heart rate, decreased over the course of the sessions. After treatment, binge eating and vomiting were almost totally suppressed in all 6 patients and during a follow-up period of 2.5-3 years, only two patients reported some occasional vomiting. Given this positive results, the same research group conducted a new study with 22 treatment-resistant BN patients [9]. After 12 cue-exposure sessions, anxiety and blood pressure increase had significantly reduced. Bingeing and purging also decreased. The authors suggest that anticipatory anxiety associated with binge eating cues triggers bulimic hunger; so, the suppression of anxiety reduces the frequency of binge behavior.

The studies reviewed show preliminary evidence of the effectiveness of ERP-B for the treatment of BN patients. The procedure is usually well tolerated and positive results are maintained and even improved during follow-up. Furthermore, ERP-B has proved useful in the treatment of patients who did not improve with CBT or drug treatment [7, 9]. Thus, it has been suggested that cue-exposure treatment may be useful as a second line of treatment in such situations [18]. However, despite initial promising results, research in this field is scarce. Some authors [18, 19] argue that the logistic difficulties and the time necessary for ERP-B have hindered the implementation of this treatment. In the abovementioned studies, patients need to bring sufficient amounts of food to the therapist's office to conduct the exposure session. In other cases, food exposure was conducted in the real environment where patients usually binged; thus requiring the therapist to move location. When exposure is conducted in the therapist's

office, the lack of ecological validity may also make it more difficult to generalize the extinction of craving/anxiety responses to everyday situations.

VR is technology that may be useful for implementing ERP-B. The possibility of simulating a real-life situation by means VR allows good ecological validity to be maintained even when exposure is conducted in the therapist's office: this facilitates generalization to real situations. Moreover, VR allows the therapist to control the different parameters of the situation and, thus, adapt the exposure environment to the needs of each patient at each stage of the treatment. So the use of VR environments, which include both contextual and proximal cues, would solve the logistic and generalization problems related with ERP-B. VR-based cue exposure has previously been used in the treatment of addiction [20-23] with positive results. Given the similarities in the mechanism underlying drug and food craving in addictive disorders and bulimia nervosa, this raises optimistic expectations for the use of VR-based cue exposure in BN treatment. VR cue exposure has also been shown to be effective for eliciting anxiety and negative emotions in patients with eating disorders (ED) [24-26], suggesting that VR cue-exposure treatment may be an effective procedure for reducing food craving and anxiety related with binge eating episodes.

3. Conclusions

The studies reviewed provide evidence of the usefulness of ERP-B for anxiety and binge eating reduction in BN patients, and offer theoretical models based on Pavlovian conditioning to explain the mechanism underlying bingeing behavior and the effectiveness of cue exposure in its reduction. Moreover, ERP-B seems to offer a good alternative for those patients who do not improve with conventional treatment [7, 8]. However, despite the possibility of obtaining positive results, the application of *in vivo* cue exposure in the therapist's office involves logistic difficulties and a lack of ecological validity. VR allows the simulation of real-life situations, providing an ecological, flexible, and controlled environment for patients' cue exposure that may overcome the difficulties detected. Therefore, the addition of VR cue-exposure treatment to conventional treatment programs is proposed as an effective procedure for reducing ED symptoms and binge eating episodes in resistant BN patients.

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