



An innovative virtual reality and eye-tracking-based attentional bias modification training into mirror exposure therapy for anorexia nervosa: preliminary findings from a case study.

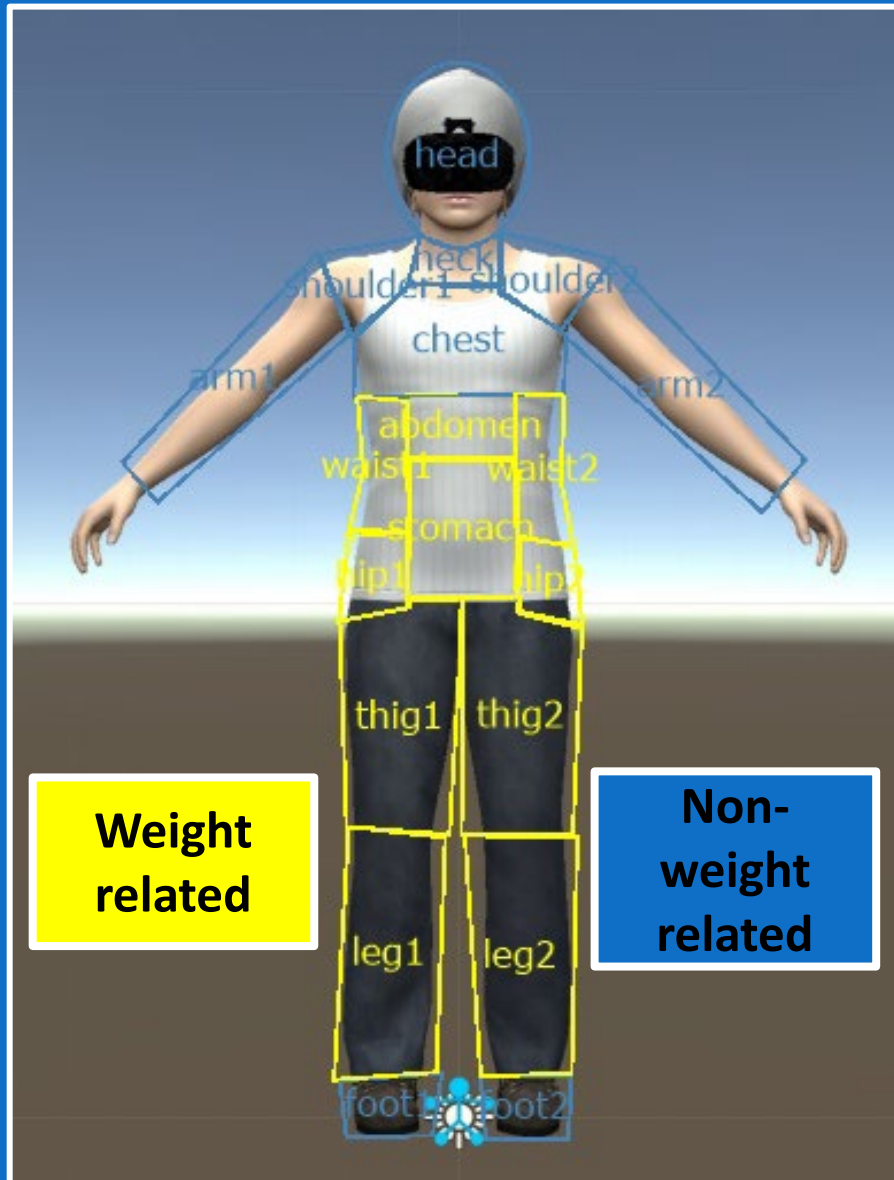
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Patients with anorexia nervosa show dysfunctional body-related attentional bias



Physical Appearance State and Trait Anxiety Scale (PASTAS; Thompson, 1999)

Body-related attentional bias



Association with
higher levels
of **body
dissatisfaction**

Interference with
the effectiveness of
the **body
exposure-based
treatments**

Body exposure-based therapies: *Mirror exposure therapy (MET)*

The way we look at our own body really matters! Body-related attentional bias as a predictor of worse clinical outcomes after a virtual reality body exposure therapy

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Abstract: Body-related attentional bias (AB) experienced by anorexia nervosa (AN) patients has been associated with body image disturbances and other eating disorders (ED)-related symptoms. The aim of this study was to assess whether the body-related AB reported by AN patients before a virtual reality (VR)-based body exposure therapy predicted worse clinical outcomes after treatment. Thirteen AN outpatients participated in the study. AB was recorded using an eye-tracker incorporated in a VR-Head Mounted Display. Results showed that AN patients attended to their weight-related body parts for longer and more frequently than to their non-weight-related body parts. Statistically significant ($p < .05$) negative and positive correlations between pre-intervention body-related AB measures and the difference between pre- and post-assessment fear of gaining weight, body dissatisfaction, and body appreciation measures were also found. Showing higher body-related AB before the intervention marginally predicted a lower reduction of fear of gaining weight ($p = .08$ and $p = .07$) and body dissatisfaction ($p = .05$ and $p = .06$) at post-treatment, and significantly predicted a lower increase of body appreciation scores after the intervention ($p < .001$). Results suggest that body-related AB may reduce the efficacy of VR-based body exposure therapy in patients with AN.

Keywords: Anorexia Nervosa, Body-Related Attentional Bias, Virtual Reality, Eye-Tracking, Body Exposure Therapy, Treatment Outcomes

MET is an effective treatment for anorexia nervosa to reduce the anxiety experienced by patients about their bodies and fear of gaining weight through a habituation process.

Patients are exposed to their real bodies over a prolonged period expressing their emotions and thoughts about their body



Looking at or avoiding looking at the most anxiety-producing body parts could interfere with the extinction of the anxiety response

ATTENTIONAL BIAS MODIFICATION TRAINING (ABMT) can reduce attentional biases

**Improve anorexia nervosa
symptomatology, such as
body dissatisfaction**

**Increase the efficacy
of body exposure
therapies**

Study purpose

Increasing the efficacy of MET by incorporating ABMT into MET in the treatment of a female adolescent with anorexia nervosa.

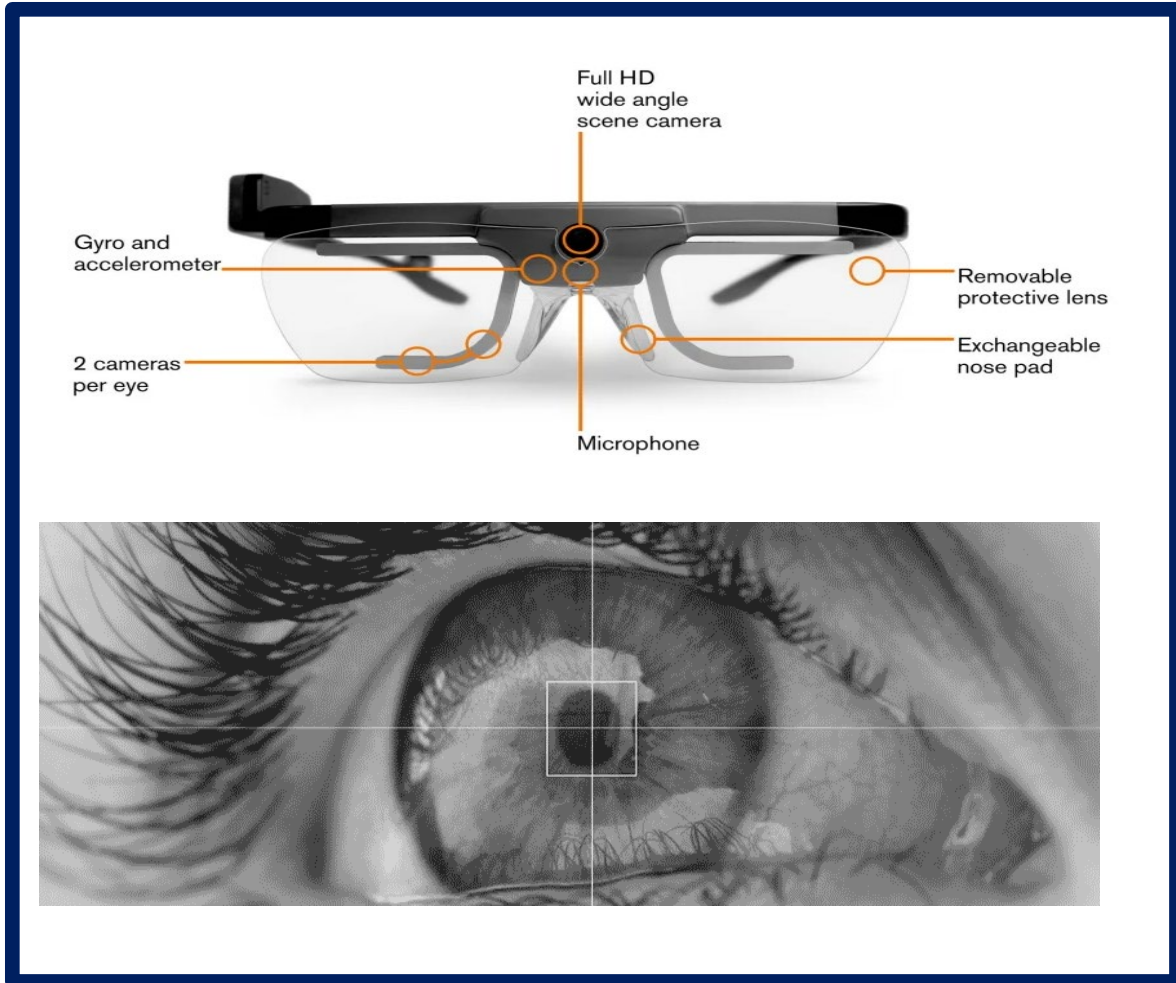
Will the mirror exposure treatment's efficacy increase by previously reducing the attentional bias?

Attentional Bias Modification Training & Mirror Exposure Therapy

Eye-tracking

+

Virtual reality



Methodology

Case description

Female

17 years old

Diagnosis: anorexia nervosa

Comorbidity: major depressive disorder

Pharmacological treatment:
anxiolytics and antidepressants

Outpatient program treatment: individual and group cognitive-behavioral therapy, nutritional rehabilitation and individual and group parent counseling

Procedure

1

Pre-treatment assessment session

2

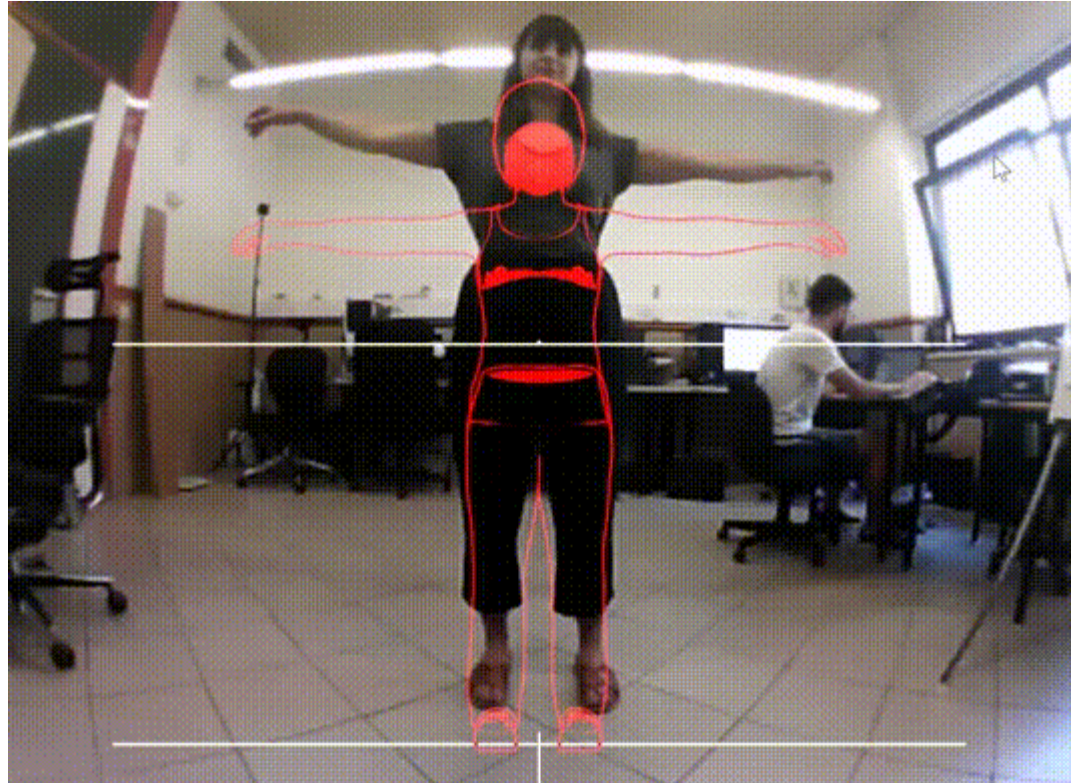
5 experimental sessions of 60 min:

- Attentional bias modification training
- Mirror exposure therapy

3

Post-treatment assessment session

Creating a personalised avatar



The virtual avatar was created by taking a patient's frontal photo which was manually overlapped on the silhouette of the virtual body by adapting the avatar's body parts to the patient's silhouette.

**In
each
clinical
session**

1

Immersion in the virtual environment

2

Full body ownership illusion

3

Attentional bias modification training

4

Mirror exposure therapy

5

Exposure to a relaxing environment

Virtual reality enviroment

Full Body Motion Tracking



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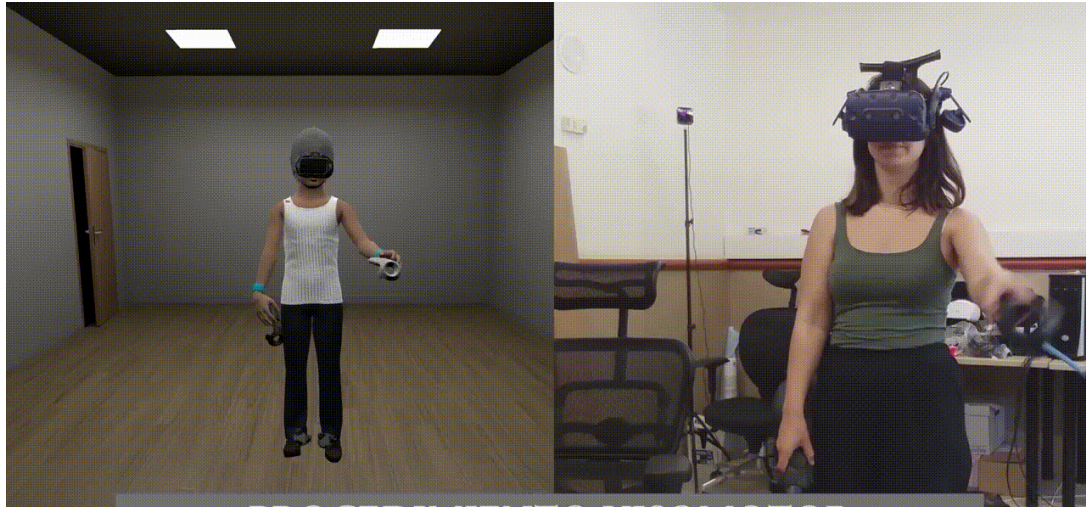
4

Mirror exposure therapy

5

Exposure to a relaxing environment

Full body ownership illusion



VISUO-MOTOR STIMULATION PROCEDURE

synchronizing the movements of the participant with the movements of the avatar using motion capture sensors placed on the hands and feet → *participant could see how the virtual body was doing the same movements as the real body.*



VISUO-TACTILE STIMULATION PROCEDURE

synchronizing the participant's visual and tactile stimulation using a tactile controller → *participant could see how her virtual body was touched by a virtual controller on the same areas of the real body touched by a real controller.*

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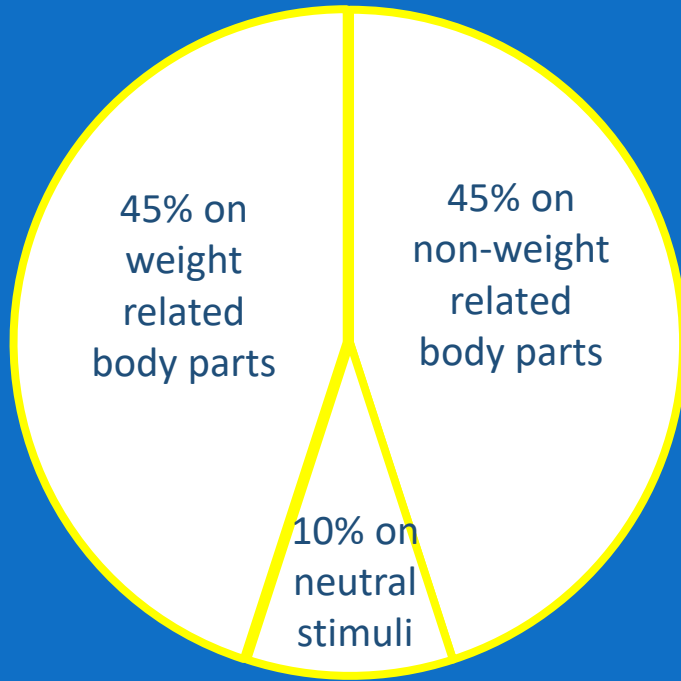
Mirror exposure therapy

5

Exposure to a relaxing environment

Attentional bias modification training

The attentional bias modification training goal was to balance the attention between weight and non-weight-related body parts



150 figures divided into two blocks of 75 figure
10-15 minutes task

The task is based on a virtual reality adaptation of the attentional bias induction procedure proposed by Smeets et al. 2011

The patient was asked to be staring for 4 seconds at the figures that appeared on a specific body part of the avatar, while it was progressively illuminated until the end of the 4 seconds, and then to move on to the next figure presentation.



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Exposure to a relaxing environment

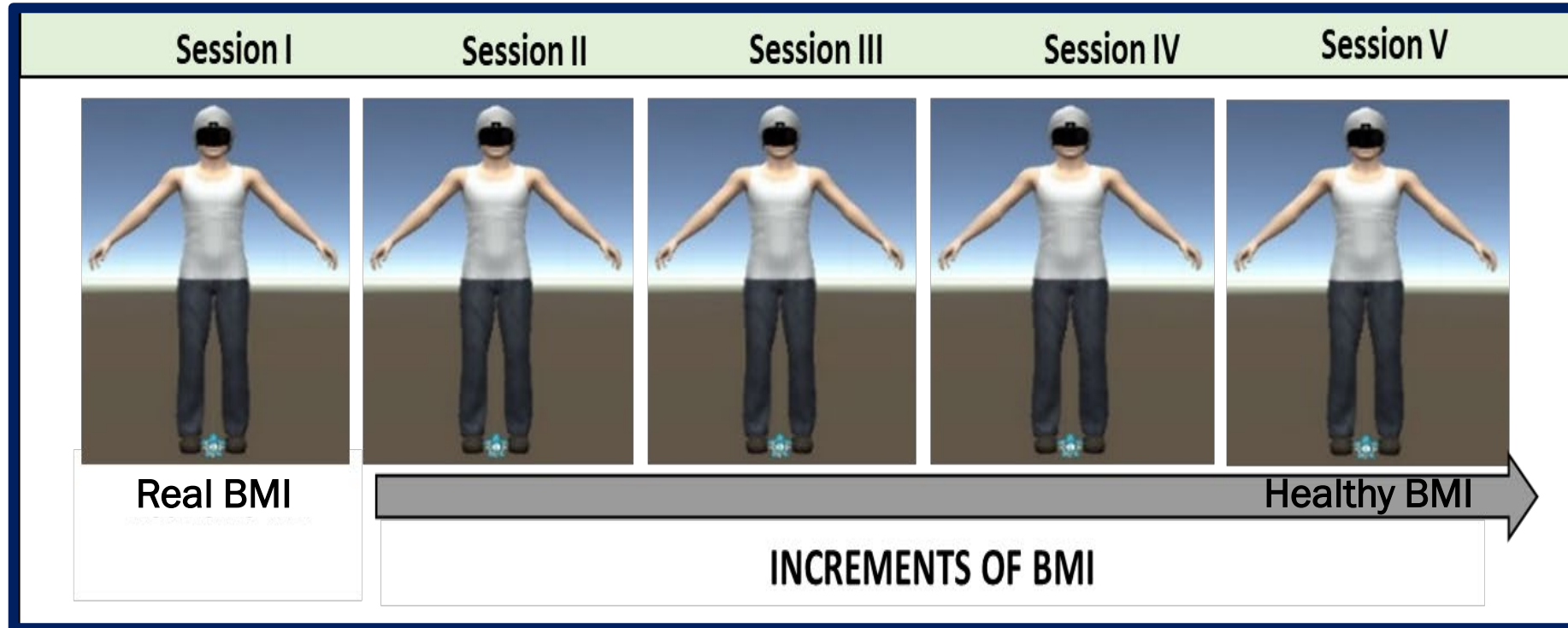
Virtual reality-based Mirror Exposure Therapy



The patient was asked to focus on different parts of the virtual body and to orally report her thoughts and feelings.

The level of experienced anxiety was evaluated every 120 seconds.

ABMT + MET SESSIONS: BMI HIERARCHY



VR technology offers the possibility of performing ABMT and MET by allowing the patient to experience the illusion of ownership of a virtual body that progressively increases weight until reaching a healthy body mass index.

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PRE-POST TREATMENT & WITHIN-TREATMENT SESSIONS MEASURES

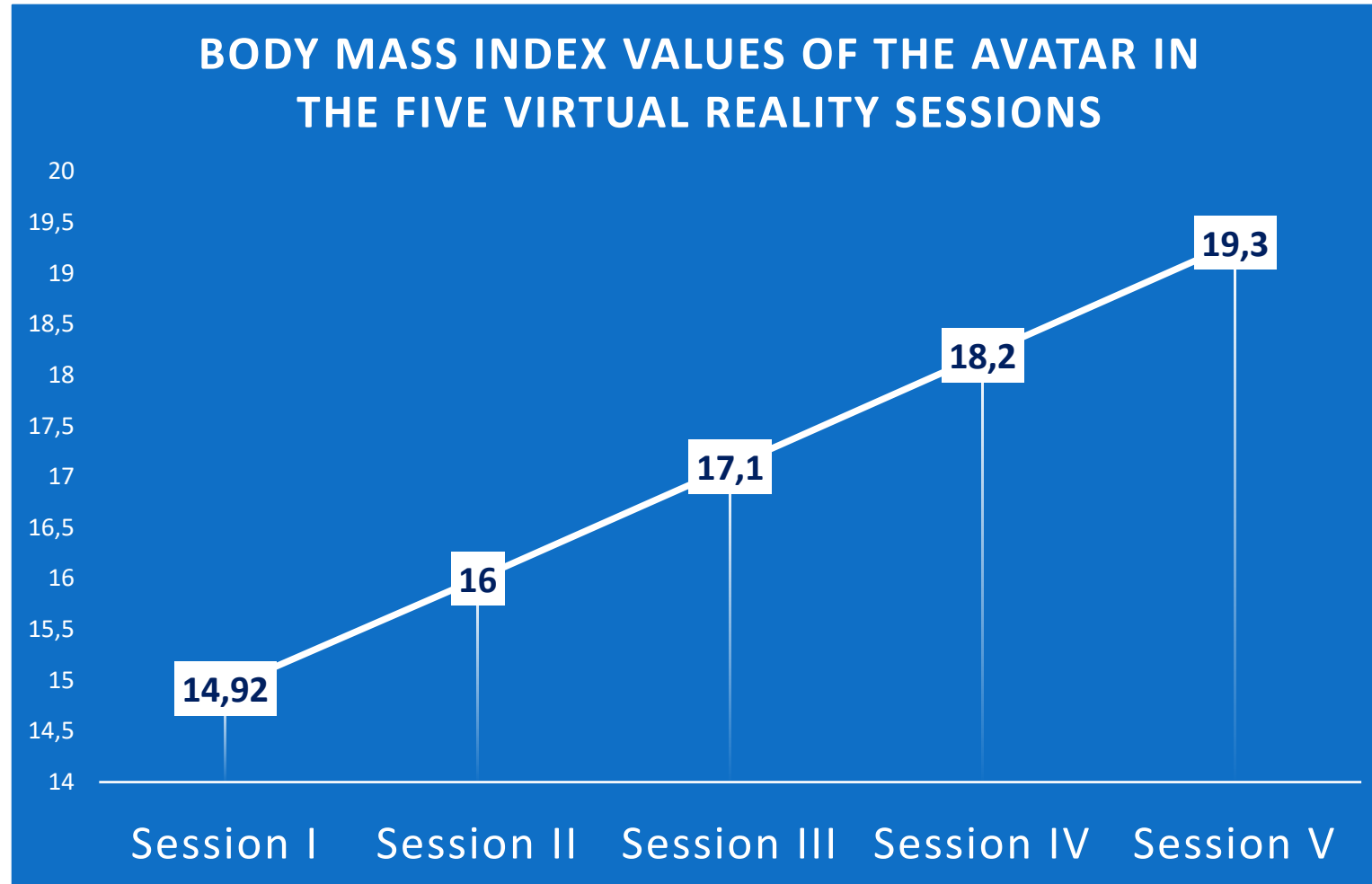
Full Body Ownership Illusion	Visual Analogue Scales (VAS) from 0 to 100
Fear of Gaining Weight	

PRE-POST TREATMENT MEASURES

Body weight	Body Mass Index (BMI)
Body dissatisfaction	Spanish version of the Body Dissatisfaction subscale of the Eating Disorder Inventory-3 (EDI-BD)
Drive for thinness	Spanish version of the Drive for Thinness subscale of the Eating Disorder Inventory-3 (EDI-DT)
Body-checking behaviors	Body Checking Questionnaire (BCQ)
Body appreciation	Body Appreciation Scale (BAS)

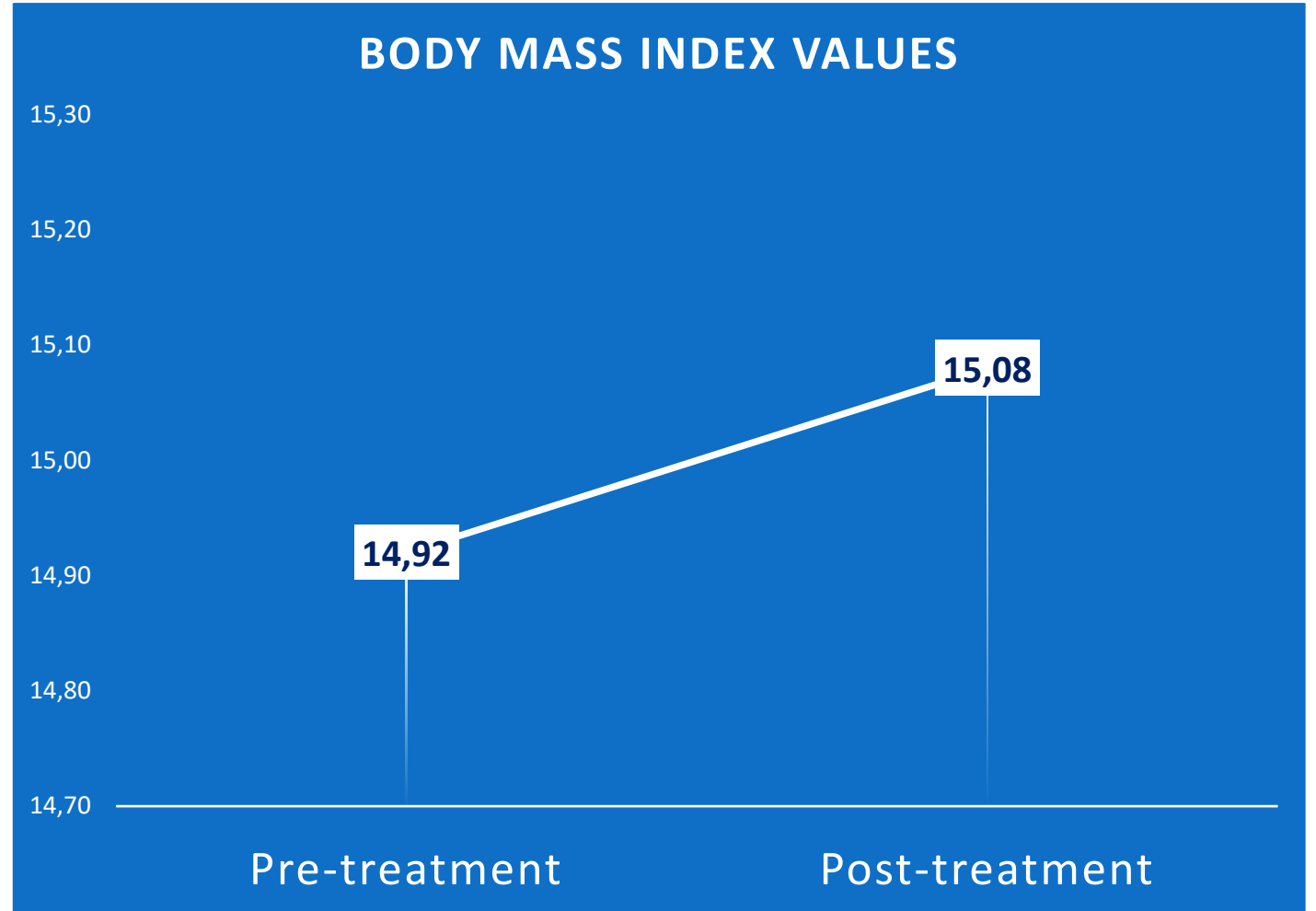
RESULTS: body mass index values of the avatar

During each session, anxiety decreased by 40% allowing the patient to progress through the virtual BMI hierarchy until she reached the minimum healthy weight of the avatar in the last session.



RESULTS: body mass index values of the patient

BMI increased slightly post-treatment without reaching the minimum healthy weight.



RESULTS

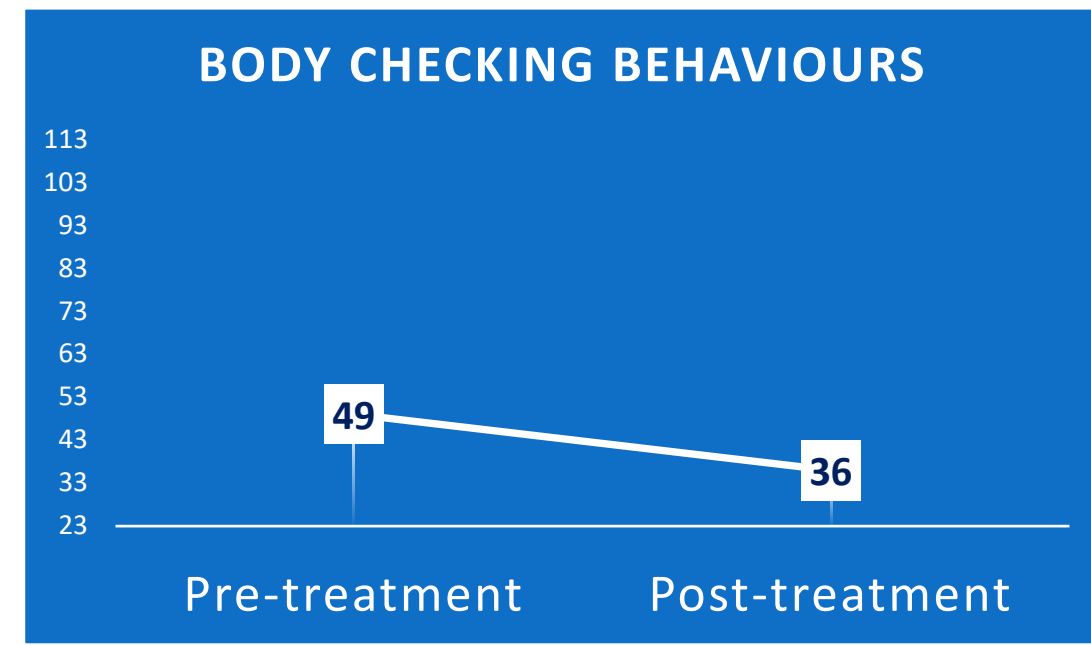
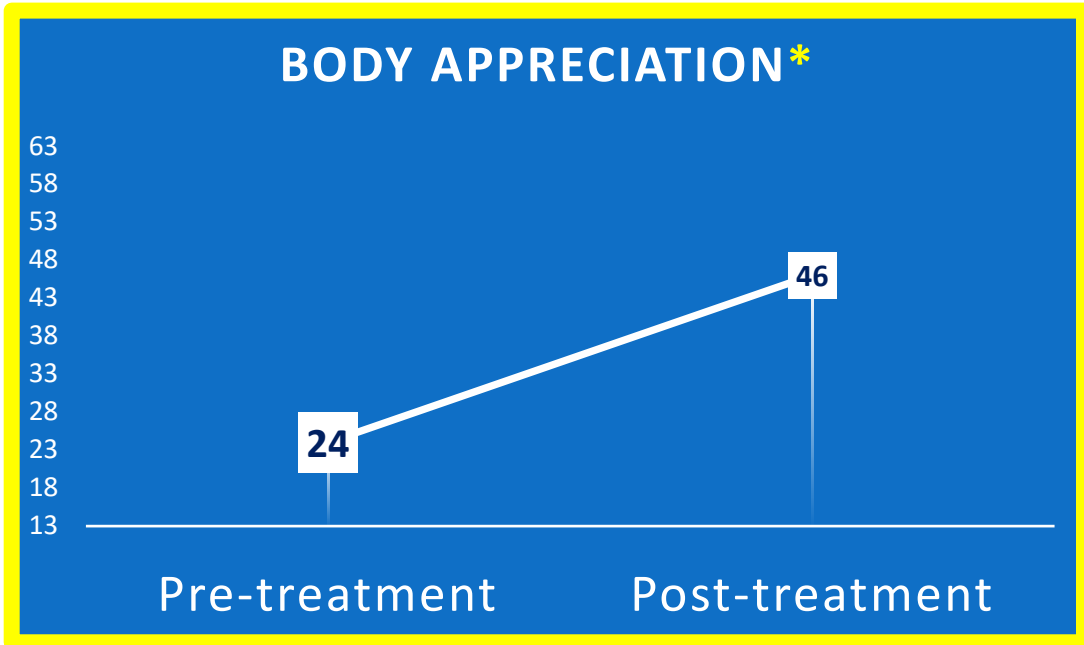
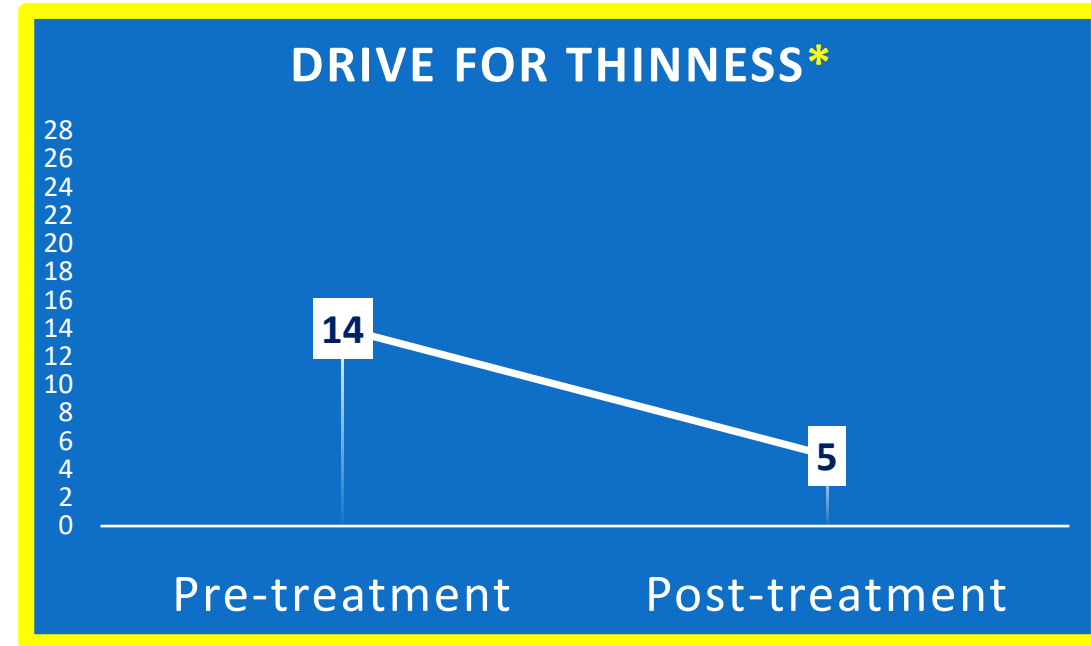
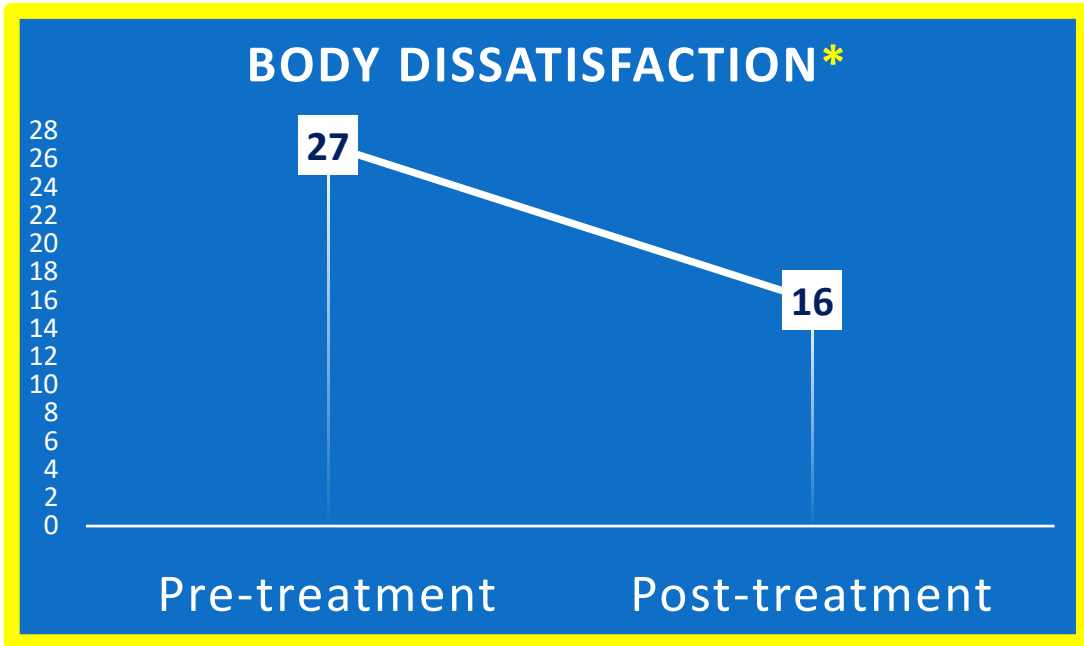
The reliable changes index (RCI) for single cases was calculated for the post-assessment measurements only for the measures with clinical and community means and standard deviations

	Pre-treatment score	Post-treatment score	Reliable Change Index
Body dissatisfaction EDI-BD	27	16	2.18*
Drive for thinness EDI-DT	14	5	2.32*
Body appreciation BAS	24	46	-5*
Body checking behaviours BCQ	49	36	1.42

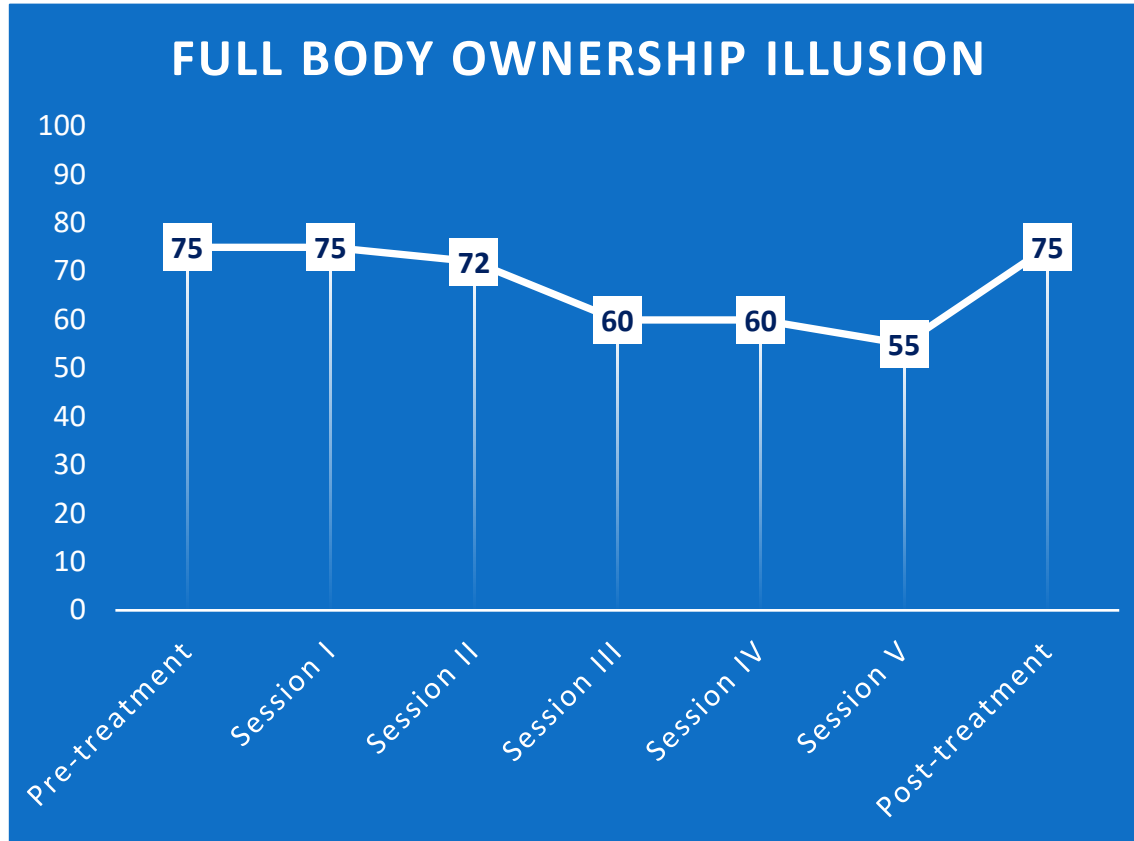
*An RCI>1.96 denotes a statistically significant difference.

RESULTS

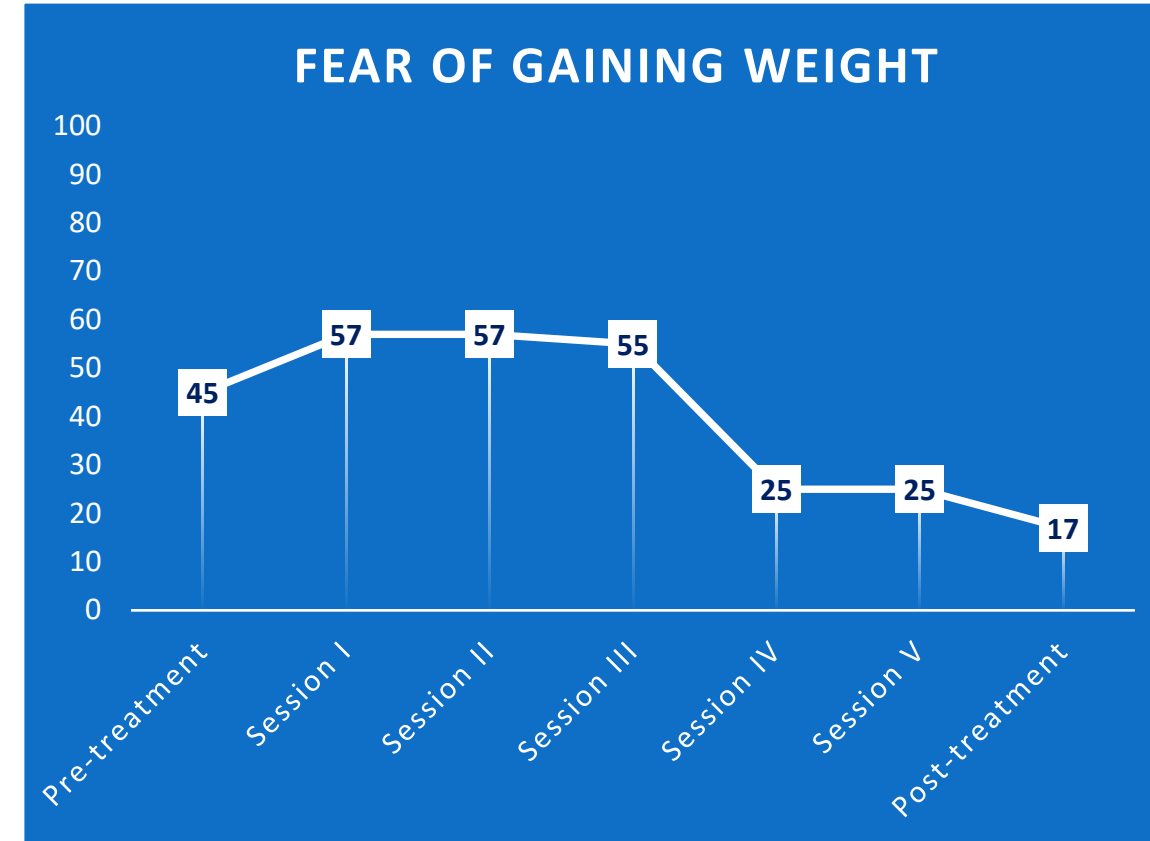
*statistically significant difference



RESULTS: Visual Analogue Scales



A medium-high level of full body ownership illusion was maintained across all sessions.



Fear of gaining weight levels decreased from the 4th treatment session onwards.

Innovations

**Incorporate a
pioneering
ABMT into MET**

**Take advantage of
virtual reality and
eye-tracking
technologies**

Future research

To advance this preliminary study and evaluate the effectiveness of incorporating ABMT into MET a controlled clinical trial is necessary.

Our group is now conducting a randomized controlled clinical trial*

Control group I



Cognitive behavioral therapy

Control group II



**Cognitive behavioral therapy
+
Virtual-reality-based
Mirror Exposure Therapy**

Experimental group



**Cognitive behavioral therapy
+
Virtual-reality & Eye-tracking-
based attentional bias
modification training
+
Virtual-reality-based
Mirror Exposure Therapy**

*Clinicaltrials.gov, NCT 04786951

Conclusions

This augmentation of MET through ABMT based on virtual reality and eye-tracking could open up a wide range of possibilities for new interventions to improve the symptomatology of patients with anorexia nervosa.



Thank you!

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