

Influence of caloric vestibular stimulation on body experience of anorectic patients

Author's Details

⁽¹⁾ Andreas Schönherr⁽²⁾ Christian Albrecht May

¹ Department of Anatomy, Medical Faculty Carl Gustav Carus, TU Dresden, Dresden, Germany

Abstract:

Distorted body experience is a central aspect of anorexia nervosa. The distortion includes perceptual, cognitive, affective and behavioral components. Whereas body-based thoughts, emotions and behavior can be transformed by a standard therapy, the actual perceived body dimension can't sufficiently be converted. Therefore, its persistence after normalizing of eating behavior can predict a relapse. Here we show that the body schema can be influenced by caloric vestibular stimulation. In two patients, showing a massive overestimation of their thigh's width, the estimation after caloric vestibular stimulation was over 100% thinner than before. Surprisingly, the patients did not become aware of this change. The body-based thoughts and emotions were not modified. Our results demonstrate the isolated influence of vestibular stimulation on body experience of anorectic patients for the first time. Its clinical implication is briefly discussed.

Keywords: *anorexia nervosa, caloric vestibular stimulation, body experience, body schema, body awareness, body image.*

Introduction

Distorted body experience is a central element of anorexia nervosa (Dilling, 2008). The patients feel „too fat“ or „just right“ although they are severely emaciated and they deny their own threatening situation (Cash & Brown, 1987). The extent of the body image distortion has a negative influence on therapy motivation and progress of the disease (Slade & Russell, 1973; Probst et al., 1997). To achieve a lasting therapeutic success, the distorted body experience should be taken into account from the beginning of the therapeutic process (Bruch, 1962; Vocks & Legenbauer, 2010). Regarding, that the patients often do not understand the significance of a body based therapy until reaching a minimal weight, the acute-therapy focuses on increase in weight to prevent them from life-threatening complications as well as to positively influence the distorted body experience and disease-denial (Garner & Garfinkel, 1997). Very often, the increase in weight is very difficult to reach, often frustrating for patients as well as the therapists and in many cases it is not successful. Regarding these facts, we searched for an alternative method to transform the distorted body experience which can help to open a “therapeutic window” for treatment.

The idea for an alternative method was found in patients suffering from neglect after stroke in the right brain hemisphere. These patients also show a distorted body experience. Their heads and eyes yaw to the site of the stroke, whereas objects on the contralateral visual field are not recognized (neglect). Furthermore they are not able to realize their obvious palsy, they even deny it's presence and cannot be convinced from the opposite. They behave as if they don't know, that they are hemiplegic (anosognosia). Performing a cold-water caloric vestibular stimulation (CVS) on the

contralateral ear to the stroke, the neglect and anosognosia can be eliminated for a few hours and the patients are able to perceive their paralyzed body parts (Rubens, 1985; Cappa et al., 1987; Vallar et al., 1993; Ramachandran, 1994; Ramachandran et al., 2004). The induced change of the body experience opens a “therapeutic window” to the paralysis and contributes to the active rehabilitation of the patients.

The presented analogies led us to the hypothesis, that CVS might be able to influence the distorted body experience in anorectic patients and can thus also open a “therapeutic window”. This idea has been mentioned but not followed by different authors (Ramachandran, 1994; Tomasino, 1996; Ramachandran et al., 2004; Mast et al., 2014). Here we present first data on the influence of CVS on different parts of body experience in anorectic patients.

Material and methods

Patients were recruited under the ICD-10 criteria of anorexia nervosa with special regards on the presence of a body schema disorder. Exclusion criteria comprise lack of cooperation and currently existing suicidality, position anomalies and inflammation of the external auditory canal, broken eardrum, and diseases of the vestibulocochlear system as well as disorders of the equilibrium organ which were found in the clinical examination. Unfortunately we could only recruit two patients which were hospitalized with malnutrition during the study period. All collected data were, according to the ethical approval, handled very confidential. The perceptual component of body experience (body schema) was detected by a thigh width (TW) estimation method (Horn & Scholz, 2009), a figure scale (Thompson & Gray, 1995) and a questionnaire for the perception of different body parts

(KEKS: Pöhlmann et al., 2009). The cognitive-affective components (notably body image) were detected by the questionnaires FKB-20 (Clement & Löwe, 1996) and PASTAS (Reed et al., 1991).

The examination contained two appointments (each between 5 pm and 8 pm) for separated stimulation of left (first appointment) and right (second appointment) vestibular organ with an interval of at least 24 hours. After testing the requirements for CVS (ear mirroring using a portable otoscope, Unterberger-test, Romberg-test, testing of nystagmus with Frenzel-glasses), the real thigh diameter was measured with an anthropometric calipers. After first estimation of TW (using both hands to show the felt TW with closed eyes), answering the questionnaires and a second estimation of TW before the CVS, the CVS was performed. Therefore we used the method according to Hallpike (Hallpike, 1956) with 27°C tempered air (air caloriser AIRMATIC II™) for 45 seconds with a subsequently one minute counting of caloric induced nystagmus (Frenzel-glasses) in a darkened room.

The ear irrigation was followed by a third estimation of TW, another answering of the questionnaire and a fourth estimation of TW. After precisely adjusting the estimated TW with their hands (and closed eyes) before and after the CVS, the patients were invited to open their eyes and having a view on their estimated TW. For analysis we used the software SPSS (IBM) for a before-and-after comparison. We furthermore used the Body-Perception-Index (Slade & Russell, 1973) as a quotient of estimated and real measurement of TW, which we calculated in the following way:

$$BPI (\%) = \left(\frac{\text{estimated amount}}{\text{real amount}} \right) * 100$$

A BPI over 100% means an overestimation and a BPI under 100% a underestimation of the real body dimension.

Results

Both patients (45 and 44 years of age) showed clear features of anorexia nervosa: BMI respectively 15.3 and 15.6 kg/m², self-induced weight loss, amenorrhea and a BPI between 250 and 391% (Table 1). Furthermore both patients chose a very corpulent figure in the figure-scale (felt and actual figure), which does not correspond to their cachectic situation, and thus presenting another clue for massive distorted body experience. In choosing a very thin desired figure (which corresponds to their real figure) the discrepancy between self-perception and actual, real situation becomes obvious. Both women were right handed and did not present any previously known abnormalities of perception. The clinical testing of the vestibular system was normal; stimulation of the vestibular system induced adequate nystagmen (Table 1). The estimated TW presented only a negligible

difference of 0.5cm between the first and second estimation before the CVS. According to this minimal difference we assumed that the basal estimation remains constant. After the CVS (on left and right ears) both patients showed significantly smaller TW than before and closer to the real measurement. According to this, the BPI reduced dramatically (Table 1). The second estimation after CVS was already different from the first one after CVS and approached to the mean of estimation before the CVS (found after left and right CVS) without reaching it. Moreover both patients described doubtfulness when estimating their TW after CVS and did not perceive their estimation more realistic (they even justified of estimating like before the CVS). After visual control of the estimated TW after CVS, both patients seemed noticeably confused and expressed their lack of appreciation about the change and the smaller estimation. In the figure-scale as well as in the other questionnaires, no change was found.

Discussion

We observed a pronounced change in the estimation of body dimension in both patients. Interestingly this change did not reproduce itself in the figure scale and the questionnaires. In addition both patients were convinced of estimating similar like before the CVS but felt unstable and surprised when watching their estimated TW after CVS. Thus, the CVS affects the body schema of anorectic patients inducing a more realistic assessment of the own body dimension. However, the patients do not become aware of it, and it cannot be measured with established questionnaires for body schema. The body related thoughts and feelings, which can be measured with questionnaires, have not been influenced by the CVS. Therefore, CVS cannot be used as a “therapeutic window” as expected from our hypothesis. However the immediately experience of seeing and comparing the estimated body dimension before and after CVS might still be useful to sensitize the patients awareness. It could be an entrance for a body-related therapy, because patients directly experience their distorted body experience and it's change.

The question remains, why the CVS is able to influence the unaware part of the perceptive component of body experience (body schema) without influencing the aware and pondered part. A recent study showed that anorectic patients unconsciously rotate their body much more before passing a gateway (which is designed wider than their actual shoulder width) as the comparison group (Keizer et al., 2013). Their distorted body experience is immediately converted into an unconscious action. In the process of estimating the TW their can also be found an unconscious and action-based representation of the

body in this present study. In contrast measuring the body experience with questionnaires, a conscious and reflected thinking process is required. Thus it is conceivable that a stimulation of the vestibular system takes place on an unconscious, action-based level (brainstem) and the conscious cognitive processes which are necessary for answering the questionnaires are only minimal affected.

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Appendix

Table 1: estimation of thigh width (TW) and number of caloric induced nystagmus before and after caloric vestibular stimulation (CVS)

	case 1: woman, 45 years old		case 2: woman, 44 years old	
	1. appointment (left ear)	2. appointment (right ear)	1. appointment (left ear)	2. appointment (right ear)
Number of Caloric induced nystamus				
Nystagmus	25	47	52	63
Estimation of TW before CVS (cm)				
1st estimation	25.0	25.5	30.5	33.5
2nd estimation	25.0	25.0	31.0	33.0
Mean	25.0	25.3	30.8	33.3
Estimation of TW after CVS (cm)				
3rd estimation	12.5	11.0	16.5	17.0
4th estimation	14.0	12.5	27.0	26.5
difference	1.5	1.5	10.5	9.5
Body Perception Index (%)				
Before CVS	250	253	362	391
After CVS	125	110	194	200

References for the BPI: measured TW, standing: case 1 10cm, case 2 8.5 cm.

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Conflict of interests

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved

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Andreas Schönherr

Christian Albrecht May