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Brief report

Preliminary physiological evidence for impaired emotion regulation in depersonalization disorder

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ABSTRACT

Depersonalization disorder is associated with emotional responding deficits. Ability to regulate emotion was measured by heart rate, skin conductance, and subjective responses to pictures. Compared to controls, depersonalized participants were better able to suppress, but not enhance, emotions irrespective of valence (heart rate). Emotion regulation in depersonalization merits further study.

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1. Introduction

Depersonalization disorder (DPD) is characterized by feelings of detachment from one's mental processes or body (American Psychiatric Association, 2000) and associated childhood interpersonal trauma, most notably emotional maltreatment (Simeon et al., 2001), alexithymia (Simeon et al., 2009), and emotional numbing (Simeon et al., 2008). DPD patients exhibit decreased skin conductance responses (SCR) to viewing emotional pictures (Sierra et al., 2002) and a differential time course of SCR during an emotional video viewing (Giesbrecht et al., 2010) compared to healthy controls. The hypoemotionality of DPD is associated with prefrontal cortex hyperactivation and limbic hypoactivation in functional magnetic resonance imaging (fMRI) (Lemche et al., 2007). This altered emotional responsiveness suggests that depersonalization may involve an impaired ability to upregulate emotion, a hypothesis previously untested. In the present study, physiologic and subjective ratings were recorded while DPD participants and controls modulated their response to emotional pictures. We hypothesized that individuals with depersonalization would have difficulty enhancing, but would be better at suppressing, emotion irrespective of stimulus valence.

2. Method

2.1. Subjects

Diagnosis was established using the Structured Clinical Interview for Dissociative Disorders-Revised (Steinberg, 1994). Participants also completed the Toronto Alexithymia Scale (TAS; Bagby et al., 1994), Childhood Trauma Questionnaire (CTQ; Bernstein et al., 2003), Beck Anxiety Inventory (BAI; Beck and Steer, 1990), Beck Depression Inventory-II (BDI; Beck et al., 1996) and Cambridge Depersonalization Scale (CDS; Sierra and Berrios, 2000). Individuals with lifetime schizophrenia or bipolar disorder, and current major depression, eating disorder, or substance use, as well as major medical conditions were excluded. The study was approved by the Mount Sinai School of Medicine and all participants gave written informed consent.

2.2. Emotion regulation task

Stimuli were 49 pictures from the International Affective Pictures System (IAPS; Lang et al., 1999; 21 pleasant, 21 unpleasant, 7 neutral). The IAPS characterizes pictures in terms of valence and arousal, which is in line with the circumplex model of affect (Russell and Barrett, 1999). Pleasant and unpleasant pictures were equivalent in arousal, but different in valence. Stimuli were not chosen to represent specific emotions and were presented once for 12 s each on a 15-in. computer screen in randomized order. A cue was presented for 4 s followed by picture onset. A verbal instruction was presented 4 s post picture onset. Consistent with Jackson et al., 2000, participants were instructed to enhance (increase the intensity of the emotion they feel), suppress (decrease the intensity of the emotion they feel), or maintain their emotional response to pleasant and unpleasant pictures, while for neutral pictures only the maintain instruction was given. No specific instructions were provided for heart rate (HR) or SCR. Participants were free to choose their regulation strategy but

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instructed not to think about things unrelated to the scene depicted. A blank screen was displayed for 12 s following picture offset. Participants then rated the picture's valence using the 9-point Self Assessment Manikin scale (Lang et al., 1999). Finally, the word "Relax" appeared onscreen for 20 s.

2.3. Skin conductance and heart rate measurement

SCR and HR were measured with two BioPac EL507 Disposable Electrodermal Electrodes that were filled with isotonic gel and placed on the middle phalanx of middle and ring finger of the non-dominant hand (Fowles et al., 1981). Before electrodes were attached, participants rinsed their hands with distilled water. SCR was recorded using a BioPac GSR100C with gain of 5 μS/V and a low-pass filter at 10 Hz. HR was recorded using a BioPac PPG100C coupled to a photoelectric pulse transducer (TSD200). Signals were sampled at 200 Hz by a BIOPAC MP150 (Biopac Systems, Goleta, CA) system connected to a data-acquisition computer running the Acknowledge v3.8.2 software package. For HR and SCR, levels in the 4 s preceding the emotion regulation instruction (resting level) and the 8 s following the instruction were averaged for each condition. These bins were then transformed by subtracting the average resting level from the subsequent instruction.

2.4. Calculation of ability scores

We a priori operationalized that a superior ability to enhance emotion would be demonstrated by an increase in score on physiologic and subjective measures of emotion compared to the maintain condition. Conversely, a superior ability to suppress would be demonstrated by a decrease in these scores compared to the maintain condition. Therefore, we calculated an ability score reflecting each individual's capacity to regulate emotion in response to pleasant and unpleasant pictures using mean values for each measure (Enhance Ability = Enhance − Maintain; Suppress Ability = Maintain − Suppress). Thus, negative ability values represent an inability to regulate emotion as instructed.

2.5. Statistical analyses

Independent *t*-test and chi-square statistics were used to analyze group differences in demographic and clinical characteristics. For subjective ratings, SCR, and HR separately, a 3 (valence) × 2 (group) repeated measures analysis of variance (RM-ANOVA) was conducted for the maintain condition, and a 2 (valence) × 2 (enhance/suppress instruction) × 2 (group) RM-ANOVA was calculated for ability scores. Mann-Whitney *U* and paired *t*-tests were used for post hoc analyses. Pearson's correlations and partial correlations controlling for depression and anxiety separately were performed between descriptive and outcome variables for the combined sample and between ability scores for each group.

3. Results

3.1. Sample characteristics

Demographic and clinical characteristics (mean ± SD) for the 14 DPD (4 women) and 14 healthy control (5 women) participants respectively were: Age: 30.8 ± 7.2 vs. 31.3 ± 11.9; Education (years): 16.6 ± 2.5 vs. 16.4 ± 2.1; CDS: 144.4 ± 49.9 vs. 12.6 ± 13.8; BDI: 25.0 ± 9.8 vs. 2.9 ± 3.2; BAI: 20.3 ± 13.4 vs. 2.8 ± 3.0; TAS: 43.1 ± 17.9 vs. 33.2 ± 10.7; CTQ: 43.1 ± 17.9 vs. 33.2 ± 10.7. Six DPD participants were taking psychotropic medications: sertraline, venlafaxine ($n=2$), quetiapine plus ramelteon, tranylcypromine, and donepezil plus lamotrigine. Three patients met current criteria for dysthymia, two for panic disorder, two for social anxiety disorder, one for generalized anxiety disorder, one for hypochondriasis, one for body dysmorphic disorder, and one for anxiety disorder, not otherwise specified. Comorbidities for three patients were missing. Age of onset of DPD was 16.6 ± 2.5 years, with a duration of 128.3 ± 33.0 months. The groups did not significantly differ in age, gender, or education. The DPD group tended toward a higher score on the CTQ ($P=0.09$) and its emotional abuse subscale compared to controls: (10.2 ± 6.2 vs. 6.6 ± 2.9, $t=-1.95$, $P=0.07$). The DPD group scored significantly higher on all other questionnaires (*P*'s <0.001).

3.2. Group comparisons

3.2.1. Maintain condition

For subjective ratings, a significant main effect for valence was found ($F_{1.385,\ 36.003}=64.81$, $P<0.001$): pleasant pictures were rated as more pleasant than neutral pictures, while unpleasant pictures were rated as more unpleasant than neutral pictures (*P*'s <0.001). There was also a trend group effect for valence ($F_{1,26}=3.25$, $P=0.083$), as DPD participants tended to rate pictures more negatively than controls. For SCR, a significant main effect for valence was found ($F_{2,50}=4.844$, $P<0.05$), reflecting increased SCR for emotional compared to neutral pictures ($P<0.025$). No significant effects were found for HR.

3.2.2. Emotion regulation ability

For subjective ratings, there was a significant main effect for valence ($F_{1,26}=17.30$, $P<0.001$) indicating all participants were better able to subjectively regulate their response to unpleasant compared to pleasant pictures. There was also a significant instruction × valence interaction ($F_{1,26}=6.00$, $P=0.02$), indicating all participants were more able to enhance emotion to unpleasant compared to pleasant pictures. Finally there was a marginal group × valence interaction ($F_{1,26}=4.21$, $P=0.050$; Fig. 1), as controls were better at modulating emotion to unpleasant than pleasant stimuli (paired $t=3.19$, $P=0.004$) while the DPD group showed no valence difference.

For HR, there was a significant group × instruction interaction ($F_{1,25}=4.56$, $P=0.03$; Fig. 1): compared to controls, DPD participants had a lesser ability to enhance ($U=246.00$, $P<0.05$) and a greater ability to suppress ($U=234.50$, $P<0.05$) emotion irrespective of valence. There were no significant findings for SCR.

3.3. Correlations

Ability to subjectively enhance unpleasant emotion was negatively correlated with depersonalization ($r=-0.42$, $P=0.03$) and alexithymia ($r=-0.46$, $P=0.01$). Ability to subjectively suppress pleasant emotion was positively correlated with childhood trauma ($r=0.55$, $P=0.003$). After controlling for anxiety, the above-mentioned correlations remained intact. After controlling for depression, only the positive correlation between ability to subjectively suppress pleasant emotion and childhood trauma was unaffected ($r=0.58$, $P=0.002$). In addition, alexithymia was negatively correlated with ability to suppress positive emotions via HR ($r=-0.44$, $P=0.03$).

For the DPD group, there was a positive correlation between HR and ratings for ability to enhance unpleasant emotion ($r=0.555$, $P=0.04$). For the control group, there was a positive correlation between HR and SCR for ability to suppress pleasant emotion ($r=0.661$, $P=0.01$). After controlling for anxiety and depression, the above-mentioned correlations remained intact. All other correlations were non-significant.

4. Discussion

To our knowledge, this is the first study examining emotion regulation in depersonalization disorder. As predicted, DPD participants exhibited an impaired ability to enhance and a heightened

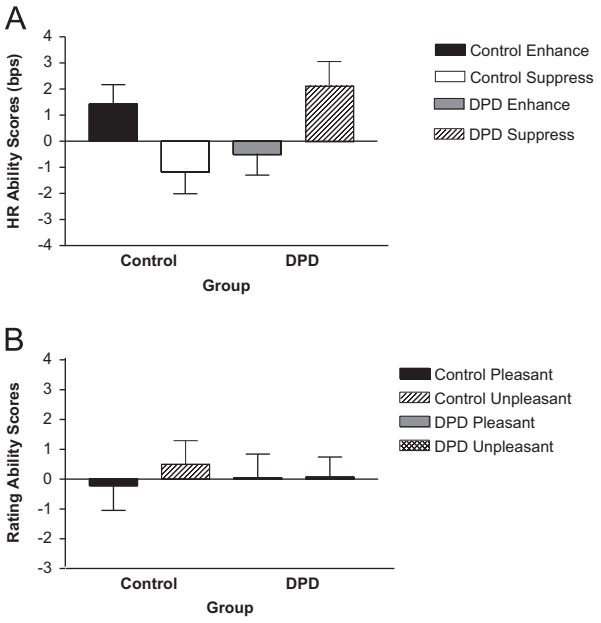

Fig. 1. Ability scores for HR and ratings: Enhance Ability = Enhance − Maintain; Suppress Ability = Maintain − Suppress. (A) HR data indicated that the DPD Group had a lesser ability to increase and a greater ability to decrease emotion. (B) There was a trend of a group × valence interaction for rating ability.

ability to suppress emotion (as indicated by HR). This was further supported by a positive association between HR and ratings for ability to enhance unpleasant emotion, indicating a direct and dynamic relationship between subjective emotion regulation and physiologic responsivity in DPD. Consistent with the hypoemotionality reported in the disorder, the inability to feel an emotion would make it impossible to increase the emotion whereas the act of suppression could employ a strategy of emotional withdrawal, resulting in reduced physiologic responsivity typical of depersonalization.

Additionally, the negative association between ability to enhance unpleasant emotion and depersonalization, as measured by subjective ratings appeared to be mediated by depression levels suggesting that the inability to subjectively upregulate unpleasant emotion seems to be due to heighted levels of depression in DPD. Germane to this finding is a study by Ehring et al. (2010) who found that recovered-depressed persons seem to employ emotional suppression more often than the control group. The relationship between suppressing and enhancing emotion should be further investigated.

The negative relationship between alexithymia and ability to subjectively enhance unpleasant emotion or suppress HR response to positive emotion (when controlling for depression) may imply that deficits in identifying emotion lead to impairments in regulating them. While alexithymia is itself a construct distinct from depersonalization, alexithymia, and in particular difficulties identifying emotion, are associated with depersonalization (Simeon et al., 2001) and may therefore contribute to the debilitating effects of the disorder.

Interestingly, childhood trauma was associated with suppression of positive emotion, diverging from the alexithymia and depersonalization findings in its impact on emotion regulation and warranting further assessment in future studies.

One important limitation of the study may lie in how we operationalized emotion regulation ability as an outcome variable. Documented inconsistencies in the literature regarding physiological responsivity both to emotional stimuli (for review, see Kreibig, 2010) as well as instructions to modulate emotions (see Urry, 2009) indicate this is a broader problem within the field which may be due to variations in methodology. While some studies diverge from our findings, studies using similar design paradigms to ours have found analogous trends in HR, SCR, and ratings in response to instruction to enhance and suppress emotion (Bernat et al., 2011; Urry, 2009). Correspondingly, the positive correlations we found between ability scores for some emotion regulation conditions lend support for our operational definitions of emotion regulation abilities for the three measures.

Findings of this study may have important treatment implications, such as utilizing therapeutic interventions that emphasize experiencing, labeling, and communication of feelings in order to more adaptively regulate emotion, that is, suppress less and enhance more. Studies investigating emotion regulation strategies more comprehensively within larger non-medicated samples and including depressive control participants are needed.

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