Abstract

It has been debated whether concentrated exposure and response prevention (ERP) is too difficult to tolerate for some patients. This report therefore uses quality assurance data looking into whether sensory processing sensitivity (SPS) affects treatment outcome among patients with OCD. SPS is a personality trait regarding heightened levels of emotional reactivity and deeper cognitive processing of emotional stimuli. Patients received concentrated exposure treatment for obsessive-compulsive disorder (OCD). They were assessed with one of the most widely used questionnaires for measuring SPS, the Highly Sensitive Person Scale (HSPS). Analyses tested whether HSPS scores at pre-treatment affected treatment outcome, and if sensitivity changed from pre- to post-treatment. Results revealed there was no significant relation between sensitivity and treatment outcome after controlling for pre-treatment levels of OCD, depression, and anxiety. HSPS scores were significantly reduced after treatment ($d =$ 1.22). This indicates that concentrated ERP is suitable also for patients scoring high on HSPS, and the main conclusion is that patients' sensitivity does not hinder treatment response.

Introduction

Patients suffering from obsessive-compulsive disorder (OCD) are disturbed by intrusive and anxiety provoking thoughts or images (obsessions), which they try to control or neutralize using behaviors or rituals (compulsions; American Psychiatric Association, 2013). The disorder is highly debilitating, and until Victor Meyer in 1966 introduced exposure and response prevention (ERP) treatment, OCD was associated with poor treatment outcomes. A large number of trials have confirmed that ERP combined with other cognitive behavioural therapy (CBT) is the recommended psychological treatment for OCD. The treatment approach can be delivered in a number of different formats, e.g. individually or to groups of patients, and widespread or concentrated. Meta-analyses have shown that about 50-70% of the patients can expect significant clinical change (Öst, Havnen, Hansen, & Kvale, 2015; Öst, Riise, Wergeland, Hansen, & Kvale, 2016; Skapinakis et al., 2016). However, given a refusal rate of 15% and a dropout rate of 15% (Öst, Havnen, Hansen, & Kvale, 2015), there is clearly a need for improving the CBT/ERP approaches in order to help more patients.

The Bergen 4-day treatment (B4DT) format for OCD seems to represent such an approach. The format is firmly rooted in evidence-based treatment with CBT, ERP, modelling and cognitive restructuring as main ingredients. However, the B4DT is not individual treatment or group treatment. It is delivered to 3-6 patients by the same number of therapists, and has thus been labelled "individual treatment in a group setting". The treatment is delivered during four consecutive days, where the two middle days can be seen as one prolonged one-session treatment. The last day consists of preparation for how to integrate the change into normal everyday living. The B4DT has low refusal and dropout rates (e.g. Launes et al., 2019). There might be a number of reasons for this. One possible reason is that patients only have to take one week off from studies or work to complete the treatment. Also, the format offers both prolonged and individually tailored sessions with a single therapist,

combined with the group format where they can observe, support, and be supported by other patients going through basically the same process of change. In addition, since the format is concentrated, the patients see the results more quickly than in other treatment formats.

The B4DT is offered within the public health care system in Norway. It uses outcome assessment as an integrated part. Several reports have demonstrated that nearly 90% of the patients are responding post-treatment and 70% are recovered four years later (Hansen et al., 2018a; Hansen et al., 2018b). A reduction of 35% or more on Y-BOCS was needed to be classified as a treatment responder, and a post-treatment score of 12 points or less to be considered recovered (Mataix-Cols et al., 2016). These rates also include the patients who refuse as well as the number of patients that drop out during the treatment. The results have been replicated to new samples of patients as well as to new clinics (Kvale et al., 2018; Launes et al., 2019). Recently a randomized controlled trial showed the same results when comparing the B4DT to self-help and waiting list (Launes et al., submitted).

Quality assessment and monitoring of treatment outcome is an integrated part of the B4DT. This allows for monitoring change and adapting treatment for the individual patient. It can also summarize treatment outcome for certain groups of patients who might need extra interventions after treatment. Previous reports have shown that severity of the disorder, number of comorbid disorders, number of previous treatments, or the patient's hardiness, do not influence treatment outcome (Havnen, Hansen, Öst & Kvale, 2017; Holm et al., 2019). These reports mirror studies that have tried to identify predictors in CBT/ERP for OCD, as it has been difficult to identify reliable predictors (Keeley, Storch, Merlo, & Geffken, 2008; Knopp, Knowles, Bee, Lovell, & Bower, 2013).

One potential predictor that has not been investigated is sensory processing sensitivity (SPS). SPS is proposed as a personality trait by Aron and Aron (1997), and involve that highly sensitive individuals perceives and processes external and internal stimuli more

intensely. Highly sensitive individuals are found to report stronger emotional reactivity and behavioral inhibition (Aron, Aron & Jagiellowicz, 2012; Aron, 2013). Being highly sensitive has been proposed to involve both an ability to detect subtle stimuli and a tendency to be overstimulated by external stimuli (Aron & Aron, 1997; Benham, 2006). This would imply that highly sensitive individuals with OCD would be expected to experience more distress related to exposure to anxiety provoking stimuli and to a higher degree seek to avoid these stimuli.

One common scale for measuring SPS is the Highly Sensitive Person Scale (HSPS; Aron & Aron, 1997) which consists of items such as "Are you easily overwhelmed by strong sensory input?", "Do you try hard to avoid making mistakes or forgetting things?", and "Do you make it high priority to arrange your life to avoid upsetting or overwhelming situations?" SPS has been associated with OCD both in children and in adults. In a case series study of six children diagnosed with OCD, Hazen et al., (2008) found that each child displayed particular sensitivity to specific ordinary sensory stimuli such as smells, textures, skin sensations and sounds (similar to what is measured with the HSPS). The children experienced distress and performed ritualistic behavior to relieve these sensations. The authors argue this is different from traditional obsessions, such as fear of contamination. They argue that, at least for a subset of patients with OCD, abnormalities in sensory processing and integration might play an important role in their OCD.

Similarly, Dar, Kahn, and Carmeli (2002) found a link between hypersensitivity to oral and tactile stimuli and ritualistic behavior in 61 children. Studies of adults have also found a significant correlation between sensitivity and OCD-symptoms, both in students (sensitivity measured with the German version of the HSPS, $r = .52$; Konrad and Herzenberg, 2017) and in a large sample of adults (sensitivity measured with Oral and Tactile Hypersensitivity Scale, $r = .34$; Dar, Kahn & Carmeli, 2002). In sum, there are already some

studies indicating a link between OCD and SPS, but none of these have investigated the relation between HSPS and OCD in a clinical setting.

It is important to monitor treatment outcome for patients with OCD in order to decide whether special adaptions are needed. CBT and ERP for OCD provokes discomfort and anxiety, and persons suffering from high sensitivity are commonly recommended to protect themselves from sensory stimulation. However, the idea that treatment is experienced as too aversive for the client has largely been based on anecdotal evidence (Lee & Rees, 2011). Even though exposure therapy is an effective treatment for anxiety disorders, many clinicians do not routinely offer it to patients, and this might be a result of clinicians' attitudes towards exposure therapy (Deacon et al., 2013; Olatunji, Deacon, & Abramowitz, 2009). Therapists' concern about whether patients tolerate the (temporary) distress caused by exposure therapy has been proposed as one of the main objections against exposure therapy. This was supported by a study by Deacon et al. (2013) who found a link between scores on the TBES (Therapist Beliefs about Exposure Scale; a scale that taps items such as fear that the clients will have difficulty tolerating the distress caused by exposure therapy), and cautious delivery of exposure treatment in hypothetical OCD case work.

One related study found that patients scoring high on Anxiety Sensitivity displayed higher levels of OCD symptoms after CBT treatment than low-scoring patients (Blakey et al., 2017). Anxiety Sensitivity is the fear of the bodily sensation of fear arousal. As sensory processing sensitivity is supposed to involve a general heightened sensitivity, one might expect similar results when investigating SPS in treatment for OCD. On the other hand, Aron and Aron (1997) claim that higher scores on sensitivity measures implies deeper cognitive processing of emotional material. Hence, patients scoring high on SPS might actually benefit more from treatment than their less sensitive peers.

Given the proposed link between OCD and sensitivity, it is important to investigate whether sensitivity might predict treatment outcome in ERP for OCD. Also, even though sensitivity is proposed as a trait (Aron & Aron, 1997), there is a lack of research on potential change over time. One study of the HSPS found a correlation of .88 on test-retest reliability after 1-3 months (Konrad & Herzberg, 2017), but apart from this study there are few accounts as to how HSPS scores changes over time.

In the current report we summarize clinical outcome for patients with OCD who have different degrees of sensory processing sensitivity. We aimed to investigate the correlation between SPS and OCD symptoms, and whether SPS was related to treatment outcome. As previous studies have found some evidence of a link between sensitivity and OCD symptoms, we expected a weak to moderate relationship between OCD and SPS. As the current treatment provokes temporary discomfort and anxiety for the patients, and patients scoring high on SPS might withdraw from such overwhelming situations, one might presume this intensive exposure treatment is too challenging for patients scoring high on the sensitivity trait. Therefore, it was an open question as to whether sensitivity would be related to treatment outcome.

Method

Participants and procedure

Patients with OCD in Norway have the right to receive evidence based psychological treatment delivered by specialist OCD-teams (Kvale & Hansen, 2014). The OCD team at Haukeland University hospital treated the OCD patients in the current paper. As an integrated part of the treatment, patients in the clinic are screened with questionnaires for a medical quality registry (consented by the Norwegian Data Protection Official (NSD/ Personvernombudet), May 5th 2012), and data for the current paper were drawn from this

registry. A measure of sensitivity was part of this procedure. Patients in the OCD-sample were diagnosed and screened for comorbid diagnoses using the MINI interview (Sheehan et al., 1998). A sample of 104 patients with OCD (73.1% female, average age 30.31 years) was included in the comparison analyses and the analyses investigating association between baseline sensitivity and treatment outcome. Out of these, 38 reported to be working, 29 were students, 11 were on a sick leave, six were out of work, five lived of disability benefits, two were homemakers, one was a pensioner, and 11 had other arrangements, such as sheltered workshops. Comorbid diagnoses were as follows; 29 patients with depression, 24 with general anxiety disorder, 12 with panic disorder, seven with social phobia, three with eating disorders, one with bipolar disorder, one with PTSD, and one with hypochondria. Table 1 displays a summary of the sample's scores on the different measures.

[Table 1 near here]

Patients received the Bergen concentrated 4-day exposure treatment (B4DT). The treatment consists of a four-day program where individually tailored treatment, consisting mainly of exposure and response prevention, is delivered in a group setting with a patient: therapist ratio of 1:1. This is followed by a three-week period of self-exposure tasks. Group treatment is not offered to patients who are non-fluent in Norwegian language, patients with ongoing psychosis, suicidal intention or drug abuse. All patients are recommended to discontinue use of anxiolytics before treatment starts. The treatment is thoroughly described in Havnen et al. (2014; 2017).

Measures

OCD. Symptoms of OCD were measured using the Obsessive-Compulsive Inventory – Revised (OCI-R; Foa et al., 2002), a self-report measure of OCD-symptoms where the

patient rates symptoms on a scale from 0 ("not at all") to 4 ("extremely"), and higher scores indicate more severe symptoms. Psychometric properties for the OCI-R are good (Foa et al., 2002; Solem, Hjemdal, Vogel & Stiles, 2010).

Symptoms of OCD were also measured using the Y-BOCS interview (Yale–Brown Obsessive Compulsive Scale; Goodman et al., 1989a; Goodman et al., 1989b), which consists of 10 items considering obsessions and compulsions rated on a scale from 0 ("none") to 4 ("extreme"). Total scores between 0-7 are considered subclinical, 8 - 15 as mild severity, 16 - 23 as moderate, 24 - 31 as severe and 32 - 40 as extreme. Trained clinicians administered the Y-BOCS interviews pre- and post-treatment and at 3- and 6-month follow-up. Post- and follow-up interviews were conducted by an independent assessor by phone, while pre-treatment interviews were conducted by a therapist at the local clinic. Psychometric properties of the Y-BOCS are good (Goodman et al., 1989a; Goodman et al., 1989b).

Sensory processing sensitivity. Sensitivity was measured using the Highly Sensitive Person Scale (HSPS; Aron & Aron, 1997) pre-treatment for all 104 patients. Eighty-three patients also answered the HSPS post-treatment. This self-report questionnaire consists of 27 items that are rated on a scale ranging from 1 ("not at all") to 7 ("extremely"). Mean item scores on the HSPS in unselected student samples usually range from 2.8 to 4.3 with *SD*s ranging from 0.54 to 0.74 (Aron & Aron, 1997; Benham, 2006, Konrad & Herzenberg, 2017). We believe it is useful to use the HSP scale, as this is one of the most widely used measures of sensitivity, and studies report good reliability and validity for the scale (Aron & Aron, 1997; Smolewska et al., 2006).

Depression. Symptoms of depression were measured using the Patient Health Questionnaire (PHQ-9; (Spitzer, Kroenke, & Williams, 1999). Psychometric properties for the PHQ-9 are adequate both in a medical setting (Gilbody, Richards, Brealey, & Hewitt, 2007) and in the general population (Martin, Rief, Klaiberg, & Braehler, 2006). A score of 5-9

Concentrated ERP treatment and sensitivity

indicates mild symptoms; 10-19 indicate moderate symptoms, while 20-27 points indicate

severe depression.

   Anxiety. Symptoms of general anxiety was measured using the Generalized Anxiety

Disorder 7-item scale (GAD-7; (Spitzer, Kroenke, Williams, & Löwe, 2006). The GAD-7 has

good reliability and validity (Löwe et al., 2008). A score on the GAD-7 of 5-9 indicates mild

anxiety; 10-14 indicate moderate anxiety, while 15-21 points indicate severe anxiety.

Statistical analyses

Partial correlations investigated the relation between sensitivity (measured with HSPS), OCD

(measured with OCI-R and Y-BOCS), anxiety (measured with GAD-7) and depression

(measured with PHQ-9), controlling for symptoms of depression and anxiety. Two

hierarchical linear regression analyses investigated whether HSPS pre-treatment predicted

treatment outcome. These were conducted using Y-BOCS and OCI-R at follow-up as

outcome variables. In the analyses, we controlled for pre-treatment levels of OCD, depression

and anxiety. We then repeated the two hierarchical regression analyses, this time comparing

the 25% of patients with highest scorers on the HSPS with the remaining 75%, as Aron &

Aron (1997) suggests sensitive individuals make up about 25% in the general population.

Finally, two repeated measures ANOVAs investigated whether sensitivity changed from pre-

treatment to post-treatment and from post-treatment to follow-up.

   Visual inspection of histograms and formal testing with Shapiro-Wiilk tests of normality,

indicated that neither Y-BOCS follow-up nor OCI-R follow up scores were normally

distributed. We removed four outliers with scores above 25 on the Y-BOCS follow-up to

correct for this (Shapiro Wiilk was then .07). For the OCI-R a square root transformation of

data resulted in normally distributed data (Shapiro Wiilk = .90). All correlations between

predictor variables were less than 0.7, and none of the Variance Inflation Factors were above

2, indicating little multicollinearity. Visual inspection of PP-plots and scatterplots, as well as

calculation of standard residuals and Cook's distance indicated linear relationship between independent and dependent variables in both cases. Finally, visual inspection of scatter plots showed rectangular patterns, indicating homoscedasticity. In sum, no violations of assumptions for regression analyses were found after correcting for normality. Missing data were only replaced for three patients, each missing only one item on the HSPS (i.e. 0.001% of the total items). We used individual mean imputation for these three scores, which has been found to be a robust method (e.g. Shrive, Stuart, Quan & Ghali, 2006).

Results

Sensory processing sensitivity as a predictor of OCD treatment outcome

To investigate the effect of HSPS on treatment outcome we used the sample of 104 patients as described above whom had all undergone the 4-day treatment. As in previously reported work, the treatment was found to be effective for the sample, with 70.1% of the patients being classified in remission (i.e. Y-BOCS $\leq$ 12) post-treatment, and 67.4% being in remission at follow-up. Mean Y-BOCS score was 26.0 pre-treatment ($n = 102$, $SD = 4.72$), 10.66 post-treatment ($n = 97$, $SD = 5.19$) and 11.20 at follow-up ($n = 95$, $SD = 5.96$).

As can be seen in Table 2, there was a weak relation between HSPS and OCI-R scores pre-treatment and at follow-up, and between HSPS and Y-BOCS scores post-treatment and at follow-up. HSPS scores were also weakly related to depression (measured with PHQ-9) and anxiety (measured with GAD-7). However, when controlling for depression and anxiety, there were no significant relations between OCD scores (measured with Y-BOCS and OCI-R) and HSPS. Hence, we found no unique relation between OCD and HSPS scores in our sample. The strongest correlation was found between sensitivity and symptoms of generalized anxiety, which was also significant when controlling for symptoms of depression.

Results from the Y-BOCS checklist suggested that patients who reported obsessions of religion, symmetry/exactness, somatic, and miscellaneous, as well as miscellaneous compulsions had higher HSPS scores than the patients without such obsessions or compulsions ($p < .05$). The remaining categories of obsessions and compulsions showed non-significant differences, while the miscellaneous obsessions category showed the largest difference ($d = 0.97$) in HSPS scores.

[Table 2 near here]

Two hierarchical linear regression analyses investigated the relation between HSPS pre-treatment and OCD-scores at follow-up. We conducted the analyses twice; once using scores on self-report forms (OCI-R) and once using Y-BOCS interview scores as dependent variables. In both cases, we controlled for pre-treatment scores on OCD (measured with the relevant instrument – OCI-R and Y-BOCS respectively), depression (measured with PHQ-9) and anxiety (measured with GAD-7). The model was not significantly predicting Y-BOCS scores at follow-up, $F(4, 83) = 2.03$, $p =.10$, but significantly predicted OCI-R at follow-up, $F(4, 68) = 7.65$, $p <.001$. Results from these analyses are presented in Table 3. HSPS was not a significant predictor of follow-up scores in either of the analyses. The regression was also repeated whilst including the four outliers. The results did not change in terms of significance as a consequence,

We then repeated the two hierarchical regression analyses, only this time we compared the top 25% highest scorers on the HSPS with the remaining 75%. The results were almost identical with the two first analyses. The model significantly predicted OCI-R at follow-up, $F(4, 57) = 6.51$, $p <.001$, but not Y-BOCS scores at follow-up, $F(4, 83) = 2.29$, $p = .07$. HSPS

Concentrated ERP treatment and sensitivity

was not a significant predictor of follow-up status in either of the analyses (p = .45 and .22 for

OCI-R and Y-BOCS scores at follow-up respectively).

[Table 3 near here]

Do HSPS scores change with treatment?

A repeated measures ANOVA revealed that sensitivity changed significantly from pre- to

post-treatment; $F(1,82) = 30.95$, $p <.001$. Average mean item score on the HSPS dropped

from 4.08 ($SD = 0.98$) points before treatment to 3.58 ($SD = 0.98$) post-treatment. Partial eta-

squared was .27 (equivalent to a Cohen's d of 1.22), indicating a large effect size. There was

no significant change in sensitivity scores from post-treatment to follow-up, $F(1,79) = 1.79$, p

$=.19$.

<div align="center">Discussion</div>

This paper reported on whether there is a relationship between sensory processing sensitivity

(SPS) and treatment outcome for patients with OCD, as it has been debated whether intensive

exposure based therapy is too difficult to tolerate for this group. The results indicated that

there was a weak correlation between HSPS and OCD symptoms, but the relation was no

longer significant when controlling for anxiety and depression. We found no significant

relation between sensitivity and treatment outcome at follow-up. Finally, we found that HSPS

scores were significantly reduced after completing treatment (Cohen's d of 1.22), indicating a

substantial change. This change seemed to last, as there was no significant difference between

post and follow-up scores on the HSPS.

Sensitivity was significantly related to OCD symptoms both pre- and post-treatment in

the OCD-group. Most notably, the obsessing subscale was the only subscale in the OCI-R

related to sensitivity. This subscale taps into intrusive thoughts and controllability of these, and the relation might indicate a link between sensitivity and obsessive thoughts. However, anxiety and depression scores were also significantly related to sensitivity, with general anxiety showing the strongest correlation with HSPS scores. Running a partial correlation controlling for anxiety and depression, OCD scores were no longer significantly related to sensitivity. Taken together, this might indicate a more general relation between psychological illness and sensitivity rather than a specific relation between OCD and sensitivity. The weak relation between OCD scores and HSPS might reflect the heightened level of anxiety and depression in our patients with OCD rather than an actual connection between OCD and sensitivity.

Our results revealed no significant relation between sensitivity and treatment outcome. This indicates that patients high on SPS profit from treatment to the same degree as their less sensitive peers. We argue this is an important finding as many therapists might be reluctant to offer exposure therapy to "sensitive" patients (Deacon et al., 2013; Lee & Rees, 2011; Olatunji et. al, 2009. Our results indicate that therapists should not be afraid to offer concentrated ERP treatment based on SPS scores. Our results also differ from the results by Blakey and colleagues (2017) who found a relation between Anxiety Sensitivity and treatment outcome. This indicates that sensory processing sensitivity might differ from anxiety sensitivity in its relation to OCD and treatment outcome.

Mean item score on HSPS was 4.08 for the OCD-group. The largest difference between our OCD sample and other previously reported samples was to the large group of German adults from the general population reported by Konrad & Herzenberg (2017; mean item score = 2.75, SD = 0.62[1]) with a Cohens d of 1.62, followed by the sample of US undergraduates reported by Benham (2006; d = 1.23, M = 3.11, SD = 0.54). Our results were

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[1] Our calculations of mean item score and SD based on original scores reported in manuscript.

not very different from the sample of US undergraduates reported by Aron & Aron (1997; $d =$ 0.35, $M = 4.38$, $SD = 0.74$). Our results are also quite similar to the study on Norwegian students by Grimen and Diseth (2016) who found an average score on HSPS of 4.05. However, their paper does not provide SDs, and therefore it was not possible to calculate the difference. It might be the case that Norwegians in general report themselves to be more sensitive than people from other nations. Future studies should look into possible differences between countries in sensitivity scores. In sum, our results indicate patients with OCD are not particularly sensitive compared with the general population in Norway.

Finally, our results revealed that patients scored lower on the HSPS after completing treatment than before treatment, and this change remained stable at follow-up. The change was considerable, with a large effect size. This might indicate that sensitivity scores are somewhat related to psychological health status, supported by our suggested link between general symptoms of psychological illness and sensitivity. This is also in line with previous studies that suggest personality traits such as harm avoidance and neuroticism might change through the course of treatment (Hedman et al., 2014; Lyoo et al., 2003). It could suggest that results from the HSPS reflect states rather than trait.

Scores on HSPS were significantly related to scores on anxiety and depression pre-treatment, the change in sensitivity scores could be related to the drop in depressive and anxiety symptoms. However, post-hoc tests revealed no significant relation between change in scores on sensitivity and changes in scores on anxiety ($n = 83$, $r = .14$, $p = .21$) or change in depression scores ($n = 83$, $r = .16$, $p = .16$). The results might also indicate that patients learn something during treatment that makes them tougher or a bit less sensitive, similar to our previous reports of resilience scores increasing in patients with OCD after completing the Bergen 4-day treatment (Holm et al., 2019). HSPS scores might decrease after exposure treatment because the primary focus of exposure therapy is learning to tolerate unpleasant

sensory experiences, both internal and external. Other factors could also explain the effect, for instance some degree of pleasing behavior. Future research should investigate this effect further in patients with other disorders.

Strengths and limitations

This is a report from a public health care clinic, summarizing the clinical outcome for patients with different degrees of sensitivity. Thus, there is no rigorous research design or selection of patients. This could also be a strength because one can argue that the ecological validity is high. However, there is a need for studies to replicate the findings and investigate the generalizability of the results between samples, cultures and treatment formats. As the results indicated there might be a general link between symptoms of psychological illness and sensitivity, it would be interesting if future studies included patients with other psychological disorders. In this paper, we have not investigated whether patients with SPS seek help more or less often, and whether general practitioners are affected by this when they decide whether to refer patients to the specialist health care or not. This might be an interesting topic for future studies.

Future studies might also be able to investigate whether the patients' sensitivity affects adherence to exposure therapy and homework or therapists' eagerness to deliver exposure therapy. However, the concentrated ERP treatment employed in the current paper is individual treatment delivered in a group setting over four consecutive days, with a 1:1 ratio between patients and therapists. The actual exposure treatment was delivered during the two middle days. The format therefore enables direct observation of therapists and group leader and direct monitoring of therapy. There is appointed a "second-in-command" for all treatment groups, who is responsible for ensuring that the protocol is followed, and that any possible deviances are reported to the group leader and dealt with immediately. All patients completed

all parts of treatment. Furthermore, as our results are based on the B4DT for OCD, we cannot draw conclusions about other treatment formats and other anxiety disorders.

One potential drawback is the use of the artificial cut-off used for 25% highest scorers on the HSPS. Another potential drawback is that we did not measure "not just right experiences" for the patients. As described in the literature, there might be a relation between "not just right experiences", which is considered to be a feature of OCD (e.g. Coles, Frost, Heimberg & Rhéaume, 2003), and specific sensory discomfort (Summers, Fitch & Cougle, 2014) as well as sensory processing difficulties (Hellriegel, Barber, Wikramanayake, Fineberg & Mandy, 2017). Hence, as we describe HSPS scores to decrease with treatment, it is impossible to tell whether this could be a result of some common factor decreasing during treatment. As there is very limited research on this area of overlap, it would be interesting if future studies could grant this topic a thorough look.

In this paper, we were not able to identify relevant pre-treatment predictors of treatment outcome. This is in line with previous research on predictors of treatment outcome for OCD (Keeley et al., 2008, Knopp et al., 2013). However, a recent study found an advantage of machine learning methods over traditional regressions to identify predictors of treatment outcome for children with OCD (Lenhard et al., 2017). Therefore, it might be relevant for future studies to investigate sensitivity using different machine learning approaches to investigate the topic further. Previous studies have shown that the B4DT yields solid treatment outcome (Hansen, et al., 2018; Havnen et al., 2014; 2017; Kvale et al., 2018) and it can be argued that reducing treatment time to four consecutive days might reduce the effect of some external factors, such as significant life events and time effects. The thorough training of the therapists required in this format, and the fact that therapists can help each other out during the course of treatment might also help reduce therapist effects.

Conclusion and Implications

Our results revealed no significant relation between sensitivity and treatment outcome. The patients scoring high on sensory sensitivity benefitted as much from the treatment as the other patients. The only significant predictor of treatment outcome at follow-up was baseline scores on OCD-symptoms. Based on our results we recommend clinicians to offer concentrated ERP treatment regardless of patients' score on SPS. Contrary to common beliefs (Deacon et al., 2013; Lee & Rees, 2011), patients rating themselves as more sensitive profited to the same degree as their less sensitive peers. Finally, we recommend research to look further into the possibility of sensitivity changing as a result of psychological treatment, as our results indicated this might be the case.

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Table 1

Descriptive statistics.

	M	*SD*	*Min.*	*Max.*
Pre-treatment				
HSPS	4.08	0.98	1.56	6.00
Y-BOCS	26.00	4.71	16.00	36.00
OCI-R	26.37	11.78	3.00	55.00
GAD-7	12.88	5.20	0.00	21.00
PHQ-9	12.50	5.97	1.00	24.00
Post-treatment				
HSPS	3.58	0.98	1.44	5.81
Y-BOCS	10.66	5.19	3.00	29.00
OCI-R	13.02	8.78	0.00	42.00
GAD-7	9.14	4.64	0.00	21.00
PHQ-9	9.07	5.71	0.00	25.00
Follow-up				
Y-BOCS	11.20	5.96	1.00	29.00
OCI-R	14.58	10.27	0.00	42.00
Age	30.31	11.06	18.00	69.00

Note: HSPS = Highly Sensitive Person Scale (mean item scores). OCI-R = Obsessive-compulsive inventory – revised. GAD-7 = Generalized Anxiety Disorder 7-item scale. PHQ-9 = Patient Health Questionnaire.

Table 2

Correlations and partial correlations between measures of OCD, depression and anxiety, and HSPS scores in the OCD group.

	N	Correlation (*r*) with HSPS pre-treatment	Partial correlation with HSPS – controlling for PHQ-9 and GAD-7
Pre-treatment			
Y-BOCS	102	.11	-.03
OCI-R	73	**.24***	.13
OCI-R Washing	73	.15	.08
OCI-R Obsessing	73	**.31****	.22
OCI-R Hoarding	73	.20	.16
OCI-R Ordering	73	.11	-.01
OCI-R Checking	73	-.07	-.11
OCI-R Neutralizing	73	.15	.12
PHQ-9	103	**.34****	.09
GAD-7	103	**.40****	**.25***
Post-treatment			
Y-BOCS	97	**.24***	.20
OCI-R	97	.10	.00
Follow-up			
Y-BOCS	95	**.23***	.15
OCI-R	93	**.21***	.11

Note: HSPS = Highly Sensitive Person Scale. OCI-R = Obsessive-compulsive inventory – revised. GAD-7 = Generalized Anxiety Disorder 7-item scale. PHQ-9 = Patient Health Questionnaire.

*Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Concentrated ERP treatment and sensitivity

Table 3

Hierarchical regression analyses investigating the relation between HSPS pre-treatment and treatment outcome for OCD sample.

Dependent variable	Step	ΔR_2 for step	Predictor variable	β	t	Sig
Y-BOCS follow-up	1	.04	Y-BOCS pre	.20	1.91	.06
	2	.04	Y-BOCS pre	.14	1.27	.21
			PHQ-9	-.03	-.21	.83
			GAD-7	.23	1.57	.20
	3	.01	Y-BOCS pre	.14	1.29	.20
			PHQ-9	-.04	-.24	.81
			GAD-7	.20	1.29	.20
			HSPS	.09	.77	.44
OCI-R follow-up	1	.26	OCI-R pre	.51	4.97	**.00***
	2	.05	OCI-R pre	.42	3.87	**.00***
			PHQ-9	.09	.62	.54
			GAD-7	.18	1.35	.18
	3	.00	OCI-R pre	.42	3.81	**.00***
			PHQ-9	.09	.62	.54
			GAD-7	.18	1.31	.20
			HSPS	.00	.03	.98

Note: Y-BOCS = Yale-Brown Obsessive Compulsive Scale. GAD-7 = Generalized Anxiety Disorder 7-item scale. PHQ-9 = Patient Health Questionnaire. HSPS = Highly Sensitive Person Scale. OCI-R = Obsessive-compulsive inventory – revised.
*Significant relations are displayed in bold.