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Dimensions of temperament and bright light response in seasonal affective disorder

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Abstract

Scale scores on the Tridimensional Personality Questionnaire (TPQ)—novelty seeking (NS), harm avoidance (HA), and reward dependence (RD)—can predict response to antidepressants. This study examined 89 patients with Bipolar Disorder (I, II) or Major Depressive Disorder, both with recurrent winter seasonal pattern. The TPQ was administered while the patients were depressed, following 10–14 days of bright light therapy (30 min, 10,000 lux) and after spontaneous springtime remission. The Structured Interview Guide for the Hamilton Depression Rating Scale—Seasonal Affective Disorder Version (SIGH-SAD) assessed the severity of depression. At baseline, there were no significant differences between diagnostic subgroups or responders and non-responders on the TPQ or SIGH-SAD scales, though baseline RD scores were significantly higher in women than men. Furthermore, neither severity of depression nor magnitude of post-treatment clinical improvement was significantly correlated with baseline TPQ scores. Only HA scores decreased after treatment, with responders showing the greatest effect. HA scores also decreased from the baseline to springtime assessments for the group as a whole, with no difference between responders and non-responders. This is the first study to demonstrate that HA is state- rather than trait-dependent in seasonal affective disorder. The TPQ dimensions of temperament do not predict response to light therapy.

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1. Introduction

Temperament has been associated with mood and response to treatment in seasonal and non-seasonal depression. The Tridimensional Personality Questionnaire (TPQ; Cloninger et al., 1991)

is a 100-item self-report inventory that consists of three scales—novelty seeking (NS), harm avoidance (HA) and reward dependence (RD). Each scale has been proposed to measure different aspects of temperament associated with distinct neurotransmitters (NS, dopamine; HA, serotonin; and RD, norepinephrine; Cloninger, 1987) and putative heritable behavioral systems. For example, individuals with high NS scores show exploratory or risky activity; individuals with high HA scores

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avoid aversive stimuli; and individuals with high RD scores seek out and maintain positive responses to rewards.

Several studies have investigated whether TPQ temperament dimensions or personality traits derived from other scales predict treatment response in seasonal affective disorder (SAD). One study found significantly higher HA scores in non-responders to bright light (Reichborn-Kjennerud and Lingjærde, 1996). Neuroticism scores, as measured by the NEO Five Factor Personality Inventory (NEO-FFI), significantly decreased following 6 weeks of bright light therapy or dawn simulation and correlated with decreases in depression scores (Sachs et al., 1996). In a related study, Neuroticism significantly decreased, Extraversion significantly increased and Openness remained unchanged following 6 weeks of bright light therapy or dawn simulation (Jain et al., 1999). By contrast, Geerts et al. (2000) reported that higher extraversion scores predicted better outcomes to light treatment. Finally, Lilie et al. (1990) found a winter-to-summer reduction in personality scale scores that fell in the abnormal range.

In addition, several studies found small but significant relationships between personality traits and seasonality. Significant correlations between neuroticism, and seasonality in SAD patients (Murray et al., 1995) and normal twins (Jang et al., 1997, 1998; Sher et al., 2000) have been found using the Eysenck Personality Questionnaire or various versions of questionnaires that measure the Five-Factor model of personality. However, Gordon et al. (1999) failed to find a significant correlation between Neuroticism and seasonality, or Neuroticism and depressive severity.

Several studies also have found significant personality trait differences between SAD patients and other clinical populations. For example, Schuller et al. (1993) found that SAD patients differed from non-seasonally depressed patients on the schizotypal, narcissistic, avoidant, dependent and passive-aggressive Millon Clinical Multiaxial Inventory-derived traits; these traits, except for avoidance, correlated significantly with seasonality (Jang et al., 1997). In addition, Bagby et al. (1996) reported significant differences between the afore-

mentioned two groups on the Openness dimension. Similarly, unipolar SAD patients differed from bipolar non-seasonally depressed patients on the Openness, Neuroticism, Extroversion and Conscientiousness dimensions (Jain et al., 1999).

TPQ dimensions also have been investigated as predictors of treatment response in non-seasonal depression. Several studies found that higher HA scores predicted poorer response to tricyclic and tetracyclic antidepressants and selective serotonin reuptake inhibitors (Joffe et al., 1993; Nelson and Cloninger, 1995; Tome et al., 1997; Hirano et al., 2002), although one study reported a positive association in which higher HA scores predicted a better response to desipramine (Joyce et al., 1994). Other studies, however, found no significant differences in TPQ scores between responders and non-responders to a variety of antidepressants (Chien and Dunner, 1996; Sato et al., 1999; Newman et al., 2000).

The HA scale, but not the NS or RD scales, has been consistently associated with mood changes and with depressive symptomatology. HA scores positively correlated with depression scale ratings in SAD (Reichborn-Kjennerud and Lingjærde, 1996) and non-seasonal depression (e.g. Brown et al., 1992; Strakowski et al., 1995; Nelson and Cloninger, 1997; Tanaka et al., 1997; Newman et al., 2000; Hirano et al., 2002). Furthermore, compared with normative (Cloninger et al., 1991) or control population data, higher HA scores during baseline depression, but not higher RD or NS scores, have been found in SAD (Reichborn-Kjennerud and Lingjærde, 1996), non-seasonal depression (e.g. Brown et al., 1992; Joyce et al., 1994; Strakowski et al., 1995; Nelson et al., 1996; Hirano et al., 2002) and dysthymia (Dunner et al., 1996; Hellerstein et al., 2000).

Similarly, HA scores, but not RD or NS scores, decreased following remission of depressive symptoms in non-seasonal depression (e.g. Joffe et al., 1993; Mulder and Joyce, 1994; Chien and Dunner, 1996; Hirano et al., 2002) and dysthymia (Dunner et al., 1996; Hellerstein et al., 2000). Such changes in TPQ scores with mood state have not previously been investigated in SAD.

TPQ scores for patients with other Axis I disorders follow a similar pattern to that for depression. For example, higher HA scores compared with scores in control subjects have been reported for bulimia and anorexia (Brewerton et al., 1993; Waller et al., 1993; Kleifield et al., 1994; Bulik et al., 1995; Berg et al., 2000), obsessive-compulsive disorder (Pfohl et al., 1990; Richter et al., 1996; Kim and Grant, 2001), and generalized anxiety disorder and panic disorder (Starcevic et al., 1996). HA scores also decreased after treatment in patients with eating disorders and anxiety disorders (Kleifield et al., 1994; Starcevic et al., 1996). Beyond state changes, high HA scores may reflect a trait of general psychopathology and constitute a temperamental risk factor for developing Axis I disorders (Joffe et al., 1993).

The TPQ also shows diagnostic subgroup differences in non-seasonal depression, with higher NS scores in bipolar than unipolar patients (Young et al., 1995). This study also found gender differences, whereby depressed women had higher RD and HA scores, but not NS scores, compared with men (Young et al., 1995). In addition, higher HA scores have been reported in female substance abusers (Nixon and Parsons, 1990). By contrast, no gender differences were detected in dysthymia (Hellerstein et al., 2000) or in obsessive-compulsive disorder (Richter et al., 1996). Such diagnostic and gender differences in temperament have not previously been determined for SAD.

This study investigated the association between treatment outcome, gender and diagnosis for the three TPQ temperament dimensions in patients with SAD. We also obtained TPQ scores following bright light treatment and during spontaneous spring remission to ascertain if there were changes associated with mood state. We predicted the following: women would have higher baseline HA and RD scores than men; bipolar patients would have higher baseline NS scores than unipolar patients; and responders would have lower baseline HA scores than non-responders. We also predicted that baseline HA scores, but not RD or NS scores, would be higher than normative values and positively correlated with severity of depression.

2. Methods

2.1. Subjects

Patients were 89 research volunteers enrolled in a winter depression light treatment studies (Terman et al., 1990, 1998), and included 69 women (77.5%) and 20 men (22.5%), ages 18–63 (mean \pm S.D., 39.79 ± 10.27 years). Sixty-seven patients [75.3%; 52 women (77.6%); 15 men (22.4%)] had Major Depressive Disorder, Recurrent (DSM-IV, 296.3; or DSM-III-R equivalent); 18 [20.2%; 13 women (72.2%); five men (27.8%)], Bipolar II Disorder [296.89 (DSM-III-R, 296.7)]; and four (4.5%; all women), Bipolar I Disorder (296.5). Depressive episodes all occurred with a seasonal pattern (winter type). Exclusion criteria, such as the presence of potentially interactive medical illness or another Axis I disorder, were identical to those used in our other studies (Terman et al., 1998). Subjects all received a physical examination with blood work and had a healthy medical status; during the protocol there was no use of psychotropic or recreational drugs or alcohol. All subjects signed informed consent prior to study entry.

2.2. Procedure

Patients were diagnosed using the Structured Clinical Interview for DSM-III-R Axis I Disorders (Spitzer et al., 1988) or the version for DSM-IV (First et al., 1995), and met National Institute of Mental Health criteria for SAD (Rosenthal et al., 1984). The TPQ was administered three times: at baseline while depressed (SIGH-SAD score ≥ 20), after daily morning or evening bright light treatment for 10–14 days (30 min, 10,000 lux), and at spring evaluation, following spontaneous remission. At each time point, symptom frequency and severity were assessed using the combined 21-item Hamilton and 8-item atypical scales of the Structured Interview Guide for the Hamilton Depression Rating Scale—Seasonal Affective Disorder Version (SIGH-SAD; Williams et al., 1994). The criterion for treatment responders ($n=43$) was a $\geq 50\%$ decrease in SIGH-SAD scores, with total score ≤ 8 (Terman et al., 1998). Springtime TPQ

Table 1
Baseline TPQ scores for each subgroup (mean \pm S.D.)

Scale	Gender		Diagnosis		Treatment response	
	Women (<i>N</i> = 69)	Men (<i>N</i> = 20)	Bipolar (<i>N</i> = 22)	Unipolar (<i>N</i> = 67)	Responders ^a (<i>N</i> = 43)	Non-responders (<i>N</i> = 46)
Reward Dependence (RD)	20.00 \pm 4.46 ^b	15.95 \pm 4.95 ^b	20.23 \pm 4.23	18.72 \pm 5.01	18.72 \pm 5.01	19.43 \pm 4.73
Harm Avoidance (HA)	17.46 \pm 7.52	16.45 \pm 7.59	18.86 \pm 7.30	16.70 \pm 7.55	17.28 \pm 7.44	17.20 \pm 7.65
Novelty Seeking (NS)	17.29 \pm 5.44	15.60 \pm 5.71	17.45 \pm 6.10	16.73 \pm 5.34	16.86 \pm 5.44	16.96 \pm 5.64

^a SIGH-SAD score reduction \geq 50%, to a level \leq 8.

^b $F_{1,84} = 8.05$, $P < 0.006$; $d = 0.89$.

and SIGH-SAD data were missing for 14 patients: eight did not appear for a springtime evaluation; three failed to complete the TPQ during that evaluation; and three failed to demonstrate a definitive springtime remission (which may have been delayed until summer).

2.3. Statistical analyses

2.3.1. Effect size

The magnitude of between-group differences in TPQ scores was expressed as effect size, d , the standardized difference between means ($d = 0.3$, small; 0.5, medium; 0.8, large; Cohen, 1988).

2.3.2. Other statistics

Multivariate analysis of variance (MANOVA), with age as a covariate, assessed subgroup differences in baseline TPQ scale scores, with gender and diagnosis as the primary ('core') comparisons. The responder/non-responder factor was added to the core, thus maximizing available sample sizes. Repeated measures MANOVA, with age as a covariate, and responder/non-responder as the comparison, determined differences in TPQ scale scores across assessment points and between groups. Pearson product-moment correlation coefficient analyses (r) quantified the relationship between TPQ scale scores and SIGH-SAD scores at baseline and springtime and between baseline TPQ scale scores and percentage change from baseline SIGH-SAD scores. One-way ANOVA determined responder/non-responder differences in baseline and springtime SIGH-SAD scores.

3. Results

3.1. Baseline

3.1.1. Subgroup differences on the TPQ scales

There were no significant differences between the bipolar and unipolar subgroups in HA, RD, or NS scores (Table 1). Also, there were no significant differences between the morning and evening light subgroups; therefore, TPQ data were pooled to form one responder and one non-responder subgroup. Again, there were no significant differences between responders and non-responders. When a more lax criterion for treatment response was used (\geq 50% decrease in SIGH-SAD score), HA, RD, or NS scores still showed no subgroup differences. Furthermore, there were no significant interactions between diagnostic and responder/non-responder subgroups in HA, RD, or NS scores. Women had significantly higher RD scores than men ($F_{1,84} = 8.05$, $P < 0.006$; $d = 0.89$; Table 1), although they showed no significant differences in HA or NS scores. Age—a covariate in all ANOVA analyses—did not differ significantly in the gender, bipolar/unipolar, or responder/non-responder subgroup comparisons.

3.1.2. Severity of depression

The SIGH-SAD score at baseline was 27.61 ± 5.42 (mean \pm S.D.), which indicates generally moderate levels of depression. Severity showed no significant correlation with age, nor was there a gender difference. Likewise, bipolar/unipolar and responder/non-responder subgroup severity comparisons and their interaction were not

Table 2
TPQ scores at the three assessment phases (mean \pm S.D.)

Scale	Baseline (N=89)	Post-treatment (N=88)	Spring remission (N=75)
Reward Dependence (RD)	19.09 \pm 4.85	19.66 \pm 4.90	19.61 \pm 4.47
Harm Avoidance (HA)	17.24 \pm 7.50 ^a	13.97 \pm 6.64 ^b	10.93 \pm 5.73 ^c
Novelty Seeking (NS)	16.91 \pm 5.51	17.41 \pm 5.23	17.47 \pm 5.11

^a Differs from post-treatment phase: $F_{1,85}=4.78$, $P<0.03$; $d=0.46$.

^b Differs from spring remission phase: $F_{1,71}=4.30$, $P<0.04$; $d=0.49$.

^c Differs from baseline phase: $F_{1,72}=5.25$, $P<0.03$; $d=0.94$.

significant. SIGH-SAD scores were not significantly correlated with HA ($r=0.09$, N.S.), RD ($r=-0.13$, N.S.), or NS ($r=0.12$, N.S.) scores.

3.2. Post-treatment effects

The percentage change from baseline SIGH-SAD scores was not significantly correlated with baseline HA ($r=-0.08$, N.S.), RD ($r=-0.11$, N.S.), or NS ($r=0.001$, N.S.) scores. HA scores decreased significantly from baseline to post-treatment ($F_{1,85}=4.78$, $P<0.03$; $d=0.46$) for both responders and non-responders (Table 2), though responders showed a significantly greater decrease ($F_{1,85}=4.16$, $P<0.05$). By contrast, RD and NS scores remained stable.

3.3. Effects of passage of the winter season

When evaluated after the time of spontaneous remission in spring, the SIGH-SAD score was 2.84 ± 3.15 (mean \pm S.D.). As at baseline, responder and non-responder subgroups showed no significant difference (2.91 ± 3.26 vs. 2.78 ± 3.09 ; $F_{1,73}=0.03$, N.S.; $d=0.04$). Similarly, they did not differ on the three TPQ dimensions. Interestingly,

the low springtime SIGH-SAD scores were significantly correlated with both baseline ($r=0.23$, $P<0.05$) and springtime ($r=0.31$, $P<0.006$) HA scores, but not with RD or NS scores. Thus, even when the depressive episode had passed, the HA dimension reflected residual symptomatology. However, just as with the positive response to light therapy in winter, HA scores significantly decreased from baseline to spring remission ($F_{1,72}=5.25$, $P<0.03$; $d=0.94$; Table 2). Again, this decline did not differ significantly between responder and non-responder subgroups. HA scores also were lower in spring than after treatment in winter ($F_{1,71}=4.30$, $P<0.04$; $d=0.49$), which reflects the presence of post-treatment non-responders whose HA scores remained relatively high. RD and NS scores were unchanged across assessment points or between subgroups.

3.4. Comparison with published TPQ data for non-seasonal depressives and population norms

Baseline RD scores in our sample were similar to a community norm (Cloninger et al., 1991; $d=0.10$, Table 3) but higher than in a group of depressed patients without a seasonal pattern

Table 3
Baseline TPQ scores for SAD, non-seasonal depression and normative samples (mean \pm S.D.)

Scale	SAD (N=89)	Non-seasonal ^a (N=168)	Normative ^b (N=1019)
Reward Dependence (RD)	19.09 \pm 4.85	16.70 \pm 4.90	19.50 \pm 4.00
Harm Avoidance (HA)	17.24 \pm 7.50	22.00 \pm 6.40	12.60 \pm 5.90
Novelty Seeking (NS)	16.91 \pm 5.51	15.70 \pm 5.20	13.00 \pm 5.00

^a Newman et al. (2000).

^b Cloninger et al. (1991).

(Newman et al., 2000; $d=0.49$). By contrast, HA scores were higher than the community norm ($d=0.77$), but lower than for non-seasonal depression ($d=0.70$); the latter difference is likely explained by a greater severity of depression in that sample than ours (Hamilton scores, 19.5 ± 3.30 vs. 15.7 ± 4.1 ; $d=1.06$). NS scores exceeded those for both the community norm ($d=0.78$) and non-seasonal depression ($d=0.23$).

4. Discussion

This study enhances our understanding of the relationship between temperament and SAD: it is the first investigation of changes in TPQ scores with mood state and of diagnostic and gender differences in temperament. HA scores decreased from winter to spring, regardless of treatment response, while RD and NS scores did not change in our SAD patients. Baseline RD scores were higher in women than men. By contrast, baseline scores did not differ between responders and non-responders or between bipolar and unipolar subgroups. Neither severity of depression nor change in depression scores after treatment was related to baseline TPQ scores. There also were no significant differences between responders and non-responders in baseline or springtime SIGH-SAD scores. We conclude that the TPQ is not an effective prognostic measure for response to light treatment in SAD patients.

Our results differ from those of Reichborn-Kjennerud and Lingjærde (1996), who found that HA scores predicted treatment response, despite a shorter study treatment duration and shorter light exposure and lower intensity of daily morning light treatment (6 days, 2 h, 1500 lux). Such differences may be due to their administration of light treatment in groups (adding a social interaction factor) or different assessment instruments. Since TPQ scores were only collected at baseline, possible score changes with mood state or treatment could not be assessed in that study.

Our findings support several studies of non-seasonal depression that also reported no differences in baseline HA scores between responders and non-responders (Chien and Dunner, 1996; Sato et al., 1999; Newman et al., 2000), but contrast

with other studies that found higher baseline HA scores in non-responders (Joffe et al., 1993; Nelson and Cloninger, 1995; Tome et al., 1997; Hirano et al., 2002). Varying results may be due to the use of different antidepressants, study designs, or other factors across studies (Mulder, 2002). Thus, it remains unclear whether HA scores predict treatment response in non-seasonal depression.

The severity of depression (assessed by baseline SIGH-SAD scores) and the change in depression scores after treatment did not correlate significantly with baseline TPQ scores in our SAD patients. By contrast, springtime SIGH-SAD scores correlated significantly with baseline HA scores, suggesting that such scores may predict the degree of spontaneous clinical improvement achieved by the time of the springtime evaluation. In addition, HA scores were highest for all patients when they were depressed compared with after treatment or when spontaneously remitted in spring. Despite their unsuccessful treatment result, the decline in HA scores in non-responders was due to a decline in depression severity falling short of our criteria for clinically significant improvement.

HA scores decreased from winter to spring in both responders and non-responders, whereas NS and RD scores remained unchanged and independent of mood. As such, responders and non-responders did not differ in springtime TPQ scores. Such results are consistent with studies of non-seasonal depression (Joffe et al., 1993; Mulder and Joyce, 1994; Chien and Dunner, 1996; Hirano et al., 2002) and dysthymia (Dunner et al., 1996), and suggest that HA scores are state-dependent, whereas NS and RD scores are trait-dependent. HA scores are likely affected by current depression and may represent non-specific responses to affective symptoms, since patients with a variety of clinical disorders, including SAD, have high baseline HA scores that decrease with treatment.

Although the TPQ did not predict response to bright light in our SAD patients, a few caveats regarding the TPQ should be noted. The TPQ measures temperament, not character, and therefore is more susceptible to influences from clinical states of anxiety and depression (Cloninger et al., 1993). Indeed, this is reflected by the number of studies that have found that HA scores positively

correlate with depression severity and decrease with successful treatment. As such, it is likely that HA scores are influenced by the depressive state at the time of instrument administration. Thus, baseline HA scores in our patients may have shown comparable elevation in both responders and non-responders due to factors contributing to depression that are not predictive of treatment response. Similarly, changes in HA scores may also reflect lability due to altered mood state and/or altered psychosocial factors rather than underlying traits. Such factors may have masked the contribution of temperament in predicting treatment response in this population.

Women scored higher on the baseline RD scale than men; however, there were no gender differences on the HA and NS scales. Young et al. (1995) also reported a gender difference in RD scores in non-seasonal depression. RD, HA and NS scores did not differ between our bipolar and unipolar patients. This lack of difference between diagnostic subgroups contrasts with findings in non-seasonal depression (Young et al., 1995), and may represent a difference between the two variants of depression or be due to our small sample of bipolar patients.

The gender difference in temperament supplements our previous findings, which indicate that women and men show different symptom profiles in the depressed and non-depressed states (Goel et al., 1999, 2002). Therefore, the TPQ identifies heterogeneous temperament traits in SAD patients, specifically those associated with the RD scale. Such traits, which include sensitivity, persistence, dedication, intimacy and sentimentality, may be implicated in either the pathogenesis or clinical presentation of the disorder.

We conclude that the TPQ does not predict response to light treatment in a large sample of SAD patients. The result might differ for SAD patients with comorbid disorders, in particular personality disorders. However, although analyses are still pending, few patients in our studies have shown clinically significant Axis II disorders. Although a high HA score may serve as a prognostic measure for determining those with a greater risk for developing SAD, it fails to predict successful response to bright light therapy.

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