Signs of Insomnia in Borderline Personality Disorder Individuals

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Study Objectives: Recent findings suggest few differences in sleep continuity and quality between borderline personality disorder individuals (BPD-I) and good sleepers (GS). Nonetheless, BPD-I show marked discrepancies between subjective and objective sleep measures. The objective of this study was to document sleep in BPD-I, GS, and insomnia sufferers (paradoxical, Para-I; psychophysiological, Psy-I).

Participants: Twelve BPD-I (mean age 33.3 years), 15 GS (mean age 34.1 years), 15 Para-I (mean age 41.1 years), and 15 Psy-I (mean age 36.6 years).

Methods: Participants underwent 3 consecutive nights of polysomnography recordings. All participants completed a clinical interview and 2 weeks of sleep diaries. BPD-I received DIB-R assessment. Participants were not suffering from any other psychopathology and were drug free.

Results: Subjectively, BPD-I and GS laboratory sleep reports were similar. However, Psy-I and Para-I took longer to fall asleep, were awake longer after sleep onset and during the night, slept less, and had lower sleep efficiency than both GS and BPD-I (p < 0.05). Objectively, BPD-I, Psy-I, and Para-I had longer sleep onset, shorter sleep time, and lower sleep efficiency on all 3 nights than GS (p < 0.05). Furthermore, BPD-I had more stage 4 (both in proportion and time) than Para-I on all 3 nights (p < 0.05).

Conclusion: Results suggest that BPD-I suffer from insomnia. While BDI-I reported feeling less refreshed upon awakening, they spent more time in stage 4 than other individuals. As BPD-I are very sensitive to loneliness and interpersonal stressors, laboratory settings might provide a secure context facilitating sleep.

Keywords: Borderline personality disorders, sleep, paradoxical insomnia, psychophysiological insomnia, PSG

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Although these results are interesting, clinical sleep measures were computed on only one night. Furthermore, stage 2 reduction was obtained on only one night and by comparing the adaptation night with the baseline night. This observation might have only been linked to a first night effect artifact. It is possible that multiple recordings might offer different results. If Philipsen et al.2 obtained subjective sleep reports, these authors did not discuss the implication of these results. It thus remains unknown if subjective sleep reports were concordant with objective reports or if clinical sleep measures were indicative of insomnia, stimulating development of the present study.

While about 30% of individuals in the general population report having a bad night of sleep occasionally, between 8% and 15% of individuals complain of chronic sleep difficulties.3,4 According to Edinger et al.,5 psychophysiological (Psy-I) and paradoxical (Para-I) insomnia sufferers differ greatly regarding sleep (both objectively and subjectively). Subjective and objective comparisons between these 2 groups are still scarce in the literature. The main feature of Psy-I is that they display a great emphasis on sleep and reports often include an inability to initiate sleep when wanted, sleeping better away from home, intrusive thoughts at night (mind racing), somatic tension, and difficulty relaxing in bed. Conversely, Para-I severely overestimate their sleep difficulties. Marked differences between subjective and objective sleep, with laboratory findings of > 6.5 hours of sleep on PSG and sleep efficiency > 85% are observed. Reported “normal” nights are rare, and sleep diaries indicate sleepless nights and no naps. Similarly, BPD-I repeatedly report having sleepless nights and rarely being able to get a good night’s sleep. These subjective reports thus resemble those reported by Para-I.

The first aim of the present study was thus to document subjective and objective sleep in BPD-I and to verify if these individuals suffer from chronic insomnia. This was accomplished by comparing subjective and objective sleep of BPD-I to the subjective and objective sleep of Psy-I, and Para-I. Subjective and objective measures of sleep were recorded and compared in these 3 groups of participants, then compared to the sleep characteristics of good sleeper controls. Our hypothesis was that the objective sleep of BPD-I would share common features with good sleepers while subjective reports would resemble those of Psy-I and Para-I.

METHODS

Participants

There were 57 adults who participated in the study, including 12 individuals suffering from borderline personality disorder (12 women; 33.3 years [10.7]), 15 individuals suffering from chronic primary psychophysiological insomnia (5 men; 36.6 years [7.1]), 15 individuals suffering from chronic primary paradoxical insomnia (4 men; 41.1 years [9.5]), and 15 self-defined good sleepers (1 man; 34.1 years [9.9]). Participants had a mean age of 36.4 years (SD = 9.5; range = 23 to 52 years). More than 96% of participants had a high school degree, 47% were single, and 61% held a full-time job. The mean duration of insomnia was 9.4 years (SD = 8.1) for psychophysiological insomnia sufferers and 13.8 years (SD = 9.7) for paradoxical insomnia sufferers.

GOOD SLEEPERS (GS)

Participants included in the GS group reported being satisfied with their sleep and (a) did not have subjective complaints of sleep difficulties, (b) did not meet diagnostic criteria for insomnia, and (c) did not use sleep-promoting medication. They also reported sleep efficiency ≥85% on the sleep diaries and no sleep difficulty of a higher level than “mild” on the Insomnia Severity Index (ISI; score < 8).

PSYCHOPHYSIOLOGICAL INSOMNIA PARTICIPANTS (Psy-I)

The individuals suffering from chronic psychophysiological insomnia had to meet the following inclusion criteria: (a) presence of a subjective complaint of insomnia, defined as difficulty initiating (i.e., sleep onset latency ≥ 30 min) and/or maintaining sleep (i.e., time awake after sleep onset ≥ 30 min) present ≥ 4 nights per week; (b) insomnia duration ≥ 6 months; (c) insomnia or its perceived consequences causing marked distress or significant impairment of occupational or social functioning (e.g., problem of concentration); and (d) presence of a subjective complaint of at least one negative daytime consequence attributed to insomnia (e.g., fatigue, mood disturbances). These participants also corresponded to the criteria set forward by Edinger et al.6 for psychophysiological insomnia.

PARADOXICAL INSOMNIA PARTICIPANTS (Para-I)

In addition to the above mentioned chronic primary insomnia criteria for Psy-I, paradoxical insomnia participants (a) had a total sleep time > 6.5 h and sleep efficacy > 85% on nocturnal polysomnography; (b) showed marked discrepancies between subjective (in-lab morning reports) and objective sleep measures (i.e., a difference ≥ 60 min for sleep latency or total sleep time, or a difference ≥ 15% between subjective and objective measures of sleep efficiency). These criteria are also in accordance with those suggested by Edinger et al.6 and discrepancies between subjective and objective sleep parameters exceed those observed for psychophysiological insomnia sufferers. The following observation is also common in Para-I: complaint of severe sleep difficulties most of the time (sleepiness nights on sleep diaries being an indicator of difficulties), and the report of normal sleep is rare. We have established that the diagnosis for paradoxical insomnia is best confirmed following the first 2 nights of laboratory recordings, and this procedure is applied in the present study.

Borderline Personality Disorder Participants (BPD-I)

To participate in the study, individuals with BPD had to: (a) meet the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV);15 (b) obtain a score ≥7 on the Diagnostic Interview for Borderline Revised (DIB-R); (c) have had the last episode of any other psychiatric lifetime diagnosis ≥ 6 months prior to the PSG investigation. Exclusion criteria were: (a) presence of a significant current medical (e.g., cancer, diabetes) or neurological disorder (e.g., dementia, Parkinson disease) that compromises sleep; (b) presence of an Axis I disorder (such as major depression, general-
ized anxiety disorder, bipolar, schizophrenia, and posttraumatic stress disorder); (c) alcohol abuse or drug dependence during the past year; (d) evidence of another sleep disorder such as sleep apnea (apnea-hypopnea index > 15) or periodic limb movements during sleep (myoclonic index with arousal >15); (e) a score ≥ 23 on the Beck Depression Inventory (BDI); (f) use of psychotropic or other medications known to alter sleep (e.g., bronchodilators); and (g) use of a sleep-promoting agent (e.g., benzodiazepines). For participants with insomnia, criteria were consistent with those of the International Classification of Sleep Disorders (ICSD-2) and the DSM-IV for chronic and primary insomnia. Participants who used a sleep-promoting medication on occasional basis (twice a week or less often) were enrolled in the study after a 2-week withdrawal period.

**Recruiting, Screening and General Procedure**

GS, Psy-I, and Para-I participants were recruited through newspaper advertisements. Following a telephone interview, eligible participants were mailed questionnaires aimed at evaluating the presence of psychological symptoms (BDI; Beck Anxiety Inventory, BAI); sleep (2 weeks of daily sleep diaries) as well as severity of sleep disturbances (ISI). Upon receipt of questionnaires, prospective participants were invited for a clinical interview at the research center. Upon arrival, informed consent was obtained. The Structured Clinical Interview for DSM-IV (SCID-I and SCID-II) and the Insomnia Diagnostic Interview (IDI) were then administered to participants.

BPD-I were recruited through advertisements at Centre de traitement Le Faubourg St-Jean, a clinic specialized in treating severe personality disorders, and which belongs to a psychiatric hospital in Quebec City (Institut Universitaire en Santé Mentale Robert-Giffard). Advertising indicated that prospective participants should not use any psychotropic medications and should present active symptoms of BPD. Recruitment was for participating in a study related to attention which included event-related potentials recorded during wake and sleep as well as neuropsychological testing. Advertisements were thus not focused on sleep. Prospective BPD-I were invited for a clinical interview at Le Faubourg St-Jean and informed consent was then obtained. The SCID-I, the IDI, and a clinical interview for BPD, the DIB-R, were administered. The Barratt Impulsiveness Scale (BIS), the Temperament and Character Inventory (TCI), the BDI, the BAI, a daily sleep diary, and the ISI were also completed.

All evaluations were conducted respectively by clinical psychologists (SG, GSJ, and SL) and a sleep specialist (CB). After the clinical evaluation, included participants were invited to undergo 3 consecutive nights of PSG recordings at the sleep laboratory. Each participant received an honorarium for his or her participation in the study.

**Materials**

**INSOMNIA DIAGNOSTIC INTERVIEW**

The Insomnia Diagnostic Interview was conducted in a semi-structured format and assesses the presence of insomnia and potential contributing factors. It is designed to identify (a) the nature of the complaint, (b) the sleep-wake schedule, (c) insomnia severity, (d) daytime consequences, (e) the natural history of insomnia, (f) environmental factors, (g) medication use, (h) sleep hygiene factors, (i) the presence of other sleep disorders, (j) the patient’s medical history and general health status, and (k) a functional analysis for antecedents, consequences, precipitating, and perpetuating factors.

**SLEEP DIARY**

The sleep diary is a daily journal used to assess subjective sleep quality. The various sleep-wake parameters derived for this study were sleep onset latency (SOL); wake after sleep onset (WASO); early morning awakening (EMA); frequency of awakenings (FNA); total wake time (TWT); total sleep time (TST); time in bed (TIB); and finally, sleep efficiency (SE), defined as the ratio of TST divided by TIB, expressed as a percentage. The sleep diary is usually completed upon arising each morning for a 2-week baseline period in order to provide a stable index of sleep complaints. In addition, our participants completed the sleep diary each morning upon awakening in the sleep laboratory. A mean was calculated for each of the derived variables.

**INSOMNIA SEVERITY INDEX**

The ISI is a reliable and valid brief self-report instrument that yields a quantitative index of perceived insomnia severity. The ISI comprises 7 items targeting the severity of sleep disturbances, the satisfaction relative to sleep, the degree of impairment of daytime functioning caused by the sleep disturbances, the noticeability of impairment attributed to the sleep problem as well as the degree of distress and concern related to the sleep problem. Each item is rated on a 5-point Likert scale, and the total score ranges from 0 to 28. A higher score reveals more severe insomnia. The ISI partly reflects the diagnostic criteria outlined in the DSM-IV.

**DIAGNOSTIC INVENTORY FOR BORDERLINE-REVISED**

The DIB-R is a semi-structured interview designed to assess borderline symptoms in four areas of functioning: affect, cognition, impulsivity, and interpersonal relationships. These sections combine the scores of 22 subsections. There is some research support for the reliability of the DIB-R.

**BARRATT IMPULSIVENESS SCALE**

The BIS-11 is a self-report measure of impulsivity consisting of 30 statements of personal characteristics. Respondents indicate the extent to which each statement applies using a 4-point scale. The raw impulsiveness measure is the sum of these responses (the larger the sum, the more impulsive is the participant). The scale can be broken into 3 subscales: motor impulsiveness (related to perseveration and unplanned action), non-planning impulsiveness (related to careful consideration of choices and problems), and attentional impulsiveness (related to focus and thought control).
The Temperament and Character Inventory

The TCI\textsuperscript{26,27} is a 238-item, self-administered, true-false questionnaire developed to assess 7 dimensions of personality. It includes 4 basic dimensions of temperament: 1) novelty seeking; 2) harm avoidance; 3) reward dependence; and 4) persistence. Three dimensions of character are measured: self-directedness, cooperativeness, and self-transcendence.

The TCI as well as the DIB-R and BIS-11 were used explicitly to either confirm or characterize borderline personality disorder participants, and no scores from these scales are reported and/or correlated with subjective or objective sleep in the present study.

Polysomnographic (PSG) Recordings

Participants spent 3 consecutive nights in the sleep laboratory. Participants were instructed to arrive at the sleep laboratory at 20:00 each night for electrode montage and preparation. Participants were asked to refrain from alcohol, excessive caffeine, and nicotine before coming to the laboratory. Bedtime was determined according to reported bedtime on the sleep diary. For all participants, lights-out was initiated after biocalibration. Time in bed was determined according to usual time in bed of participants from the sleep diary, with $\geq$ 8 hours of PSG recordings.

A standard PSG montage was used, including electroencephalographic (EEG; including C\textsubscript{3}, C\textsubscript{4}, O\textsubscript{1}, O\textsubscript{2}, F\textsubscript{3}, C\textsubscript{z}, P\textsubscript{3}, P\textsubscript{z}), electro-myographic (EMG; chin) and electro-oculographic (EOG; left and right: supraorbital ridge of one eye and the infraorbital ridge of the other) recordings. This placement allowed for eye movement artifact and blinks to be subtracted from ongoing EEG.\textsuperscript{29} Electrodes were referred to linked mastoids with a forehead ground, and interelectrode impedance was maintained $<5$ kOms. Respiration and tibialis EMG were monitored during the first night of PSG recording in order to rule out sleep apnea and periodic limb movements. Participants diagnosed with another sleep disorder were excluded and referred to appropriate sleep specialists. A Grass Model 15A54 amplifier system (Astro-Med Inc., West Warwick, RI, USA; gain 10000; band pass 0.3-100 Hz) was used. PSG signals were digitized at a sampling rate of 512 Hz using a commercial software product (Harmonie, Stellate System, Montreal, Canada). Sleep recordings were scored visually (Luna, Stellate System, Montreal, Canada). Sleep recordings were scored and/or correlated with subjective or objective sleep patterns from lights off with the intention to sleep to the first moment from lights off with the intention to sleep to the first REM sleep. Statistical Analyses

Objective measures of sleep included SOL (defined as the time spent in bed that was not spent in sleep), TST, TWT, TST, WASO, TLE, and time to first REM sleep. Objective comparisons were performed on the first three nights of PSG recordings. MANOVA was performed using the software package Statistica 8.0 (Statsoft, Tulsa, OK). All analyses were performed with a $p$ value of 0.05. The characteristics of participants are depicted in Table 1. Statistical analyses showed that GS, BPD-I, Psy-I, and Para-I were similar according to gender, $\chi^2(3, N = 57) = 7.228, p = 0.07$, and age, $F_{3,53} = 2.01, p = 0.12$.

Both groups of INS and BPD-I, compared to GS, had higher scores on the ISI, $F_{3,51} = 39.37, p < 0.001$, this higher score being indicative of greater severity of insomnia symptoms. As such, BPD-I and both groups of insomnia sufferers reported similar severity of sleep difficulties. Also, both groups of INS and BPD-I expressed more depressive and anxious symptoms than GS as reported on the BDI, $F_{3,51} = 11.91, p < 0.001$, and BAI, $F_{3,51} = 6.57, p < 0.001$. Although, all participants remained under the clinical threshold for psychiatric syndrome, BPD-I displayed more depressive symptoms than the other 3 other groups (mean difference 13.8, 11.8, and 11.1, $[p < 0.001]$ for GS, Psy-I, and Para-I) and more anxious symptoms than GS and Psy-I (mean difference 11.9 and 7.7, respectively).

Compared to GS, the other 3 groups of participants (BPD-I, Psy-I, and Para-I) reported lower SE, $F_{3,45} = 20.8, p < 0.001$, longer TWT, $F_{3,45} = 19.4, p < 0.001$, and shorter TST, $F_{3,45} = 12.1, p < 0.001$, on the 2 weeks of sleep diaries preceding the laboratory recordings. In addition, Psy-I reported shorter TWT and better SE than Para-I ($p < 0.028$ and $p < 0.025$, respectively). BPD-I were comparable on all measures to both Psy-I and Para-I groups. All groups were similar on TIB.

In addition, after completion of the clinical interview, a mean duration of insomnia of 9.3 years (SD = 8.7) was reported by BPD-I. This duration was similar to the ones reported by Psy-I and Para-I. Along with other clinical reports and characteristics previously reported, it thus appeared that BPD-I suffered from chronic insomnia.

Comparisons Between Objective and Subjective Sleep Measures

Table 2 shows results from independent $t$-tests for 15 pairs of comparisons between sleep measures of objective (PSG) and subjective sleep measures (sleep diary questionnaire in
the morning) for laboratory nights 1, 2, and 3 for each group of participants. As depicted in Table 2, within groups differences revealed that BPD-I was the group for whom objective and subjective sleep measures on the 3 nights were the most similar (14 of 15 comparisons), while Para-I was the group of participants whose comparisons between objective and subjective sleep measures differed the most (14 of 15 comparisons). Psy-I differed in their estimation 47% of times, while GS differed 27% of the times.

BPD-I subjective measures from the sleep laboratory were similar to those observed polysomnographically, except for the number of awakenings on the second night. In Para-I, marked discrepancies were observed between subjective and objective reports; only WASO on the adaptation night was correctly estimated. Psy-I consistently underestimated the number of awakenings and overestimated WASO on all 3 nights, although this latter difference was less important than the one found in Para-I. For GS, differences in subjective and objective sleep characteristics were observed almost exclusively on the third night.

An additional subjective measure aimed at comparing sleep in the laboratory to the usual sleep at home labelled “quality of sleep in the sleep lab vs quality of sleep at home” was computed on each night. Quality of sleep was scored on a 5-point Likert scale, from 1 to 5 (1 = much worse; 2 = worse, 3 = same; 4 = better; 5 = much better). GS estimated having slept worse in the laboratory than at home (means = 2.3, 2.5, and 2.7 from the first to the third night, respectively), both Psy-I and Para-I evaluated the quality of the 3 nights in the laboratory as being similar to their sleep at home (2.8, 3.0, and 2.9 for Psy-I and 2.7, 3.0, and 2.9 for Para-I on the 3 nights, respectively). On the other hand, BPD-I rated their sleep in the laboratory as being a bit better than the one at home (from 3.3, 3.4, and 3.3 respectively for each night). ANOVAs revealed that these individuals reported feeling significantly less restored upon awakening (p < 0.001) than any other groups of individuals.

### Between-Groups and Night Effects on Subjective and Objective Measures of Sleep

Clinical objective data (SE, SOL, number of awakenings, WASO, and TST) are depicted in Table 2. Table 3 reports on other PSG data for all groups of participants. Repeated measures ANOVAs revealed significant differences on both subjective and objective data. Significant effects (F and p values) can be found in Table 4.

### Subjective Data

BPD-I and GS subjective reports in the sleep laboratory were similar on the 3 recording nights. On the other hand, Psy-I and Para-I subjectively took longer to fall asleep, were awake longer after sleep onset and during the night, slept less, and had a lower SE than both GS and BPD-I (p <0.05). Furthermore, Para-I reported more total wake time, less sleep time, and a lower sleep efficiency than Psy-I (p <0.05). No other significant differences were observed for subjective data.

### Objective Data

On objective measures, BPD-I, Psy-I, and Para-I had longer SOL, shorter sleep time and lower sleep efficiency on all 3 nights than GS (p < 0.05). Psy-I took longer to fall asleep, slept less, and had a significantly lower sleep efficiency than GS. Finally, BPD-I had more stage 4 (both in proportion and time) than Para-I on all 3 nights (p < 0.05). No other significant differences were observed for objective measures of sleep.

### Night-to-Night Comparisons

From Night 1 to Night 3, significant differences were observed for SOL, objective SE, and percentage and minutes of Stage 4 sleep (p < 0.05). Generally, all participants reported and also objectively took less time to fall asleep from Night 1 to
reported having slept better in the sleep laboratory than at home though BPD-I spent more time in stage 4 sleep than Para-I and groups of sleepers when studied in the sleep laboratory. Even features with Para-I insomnia sufferers more than with other compared to GS. Thus, BPD-I do not appear to show common recordings underline longer sleep onset, less total sleep time and of insomnia sufferers. Nonetheless, objective data from PSG re closer in their estimations to good sleepers than to both groups between objective and subjective measures of sleep, they were objective sleep data. Since BPD-I showed no discrepancies be BPD-I showed the best concordance between subjective and parameters, which is the group definition criterion. Unexpectedly, between subjective estimates of sleep and objective sleep pa nightmares as confirmed during the IDI.

Although nightmare occurrences are not available in the current Our results suggest that BPD-I suffer from chronic insomnia. BPD-I, Para-I, and Psy-I were similar but different from GS. characteristics with both groups of insomnia sufferers than hypothesized that BPD-I would subjectively share more common

The picture is less clear for BPD-I. Although subjective reports on sleep diaries and high scores on the ISI along with the clinical interview confirmed that these individuals suffered from chronic insomnia, subjective in-laboratory sleep patterns were not confirmed by objective sleep measures (although WASO was close to the arbitrary cut-off usual for maintenance insomnia (see Table 2, Night 1 and 2). A recent study by Philipsen et al. also observed few differences between objective and subjective sleep patterns in BPD-I compared to controls. As mentioned earlier, in regard to insomnia, it has been previously observed that objective sleep patterns do not always reflect the subjective complaint. Furthermore, a PSG evaluation, although characterized as a gold standard, is not recommended for the diagnosis of insomnia. One might also argue that ambulatory recordings

Table 2—Means and SD (in Parentheses) of 15 Pairs of Laboratory Sleep Parameters (Objective - PSG vs Subjective - Sleep Diary in the Morning) for all Four Groups of Participants, Within Groups Comparisons

<table>
<thead>
<tr>
<th></th>
<th>BPD-I (n=12)</th>
<th></th>
<th>Psy-I (n=15)</th>
<th></th>
<th>Para-I (n=15)</th>
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<th>GS (n=15)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>objective</td>
<td>subjective</td>
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<td>Night 1</td>
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<tr>
<td>1. SE %</td>
<td>85.0 (12.3)</td>
<td>80.3 (20.4)</td>
<td>77.8 (15.9)</td>
<td>77.1 (13.0)</td>
<td>83.7 (6.6)</td>
<td>64.8 (18.1)**</td>
<td>90.7 (5.7)</td>
</tr>
<tr>
<td>2. SOL</td>
<td>20.7 (19.2)</td>
<td>24.5 (17.5)</td>
<td>36.2 (39.2)</td>
<td>52.3 (47.1)**</td>
<td>20.8 (14.5)</td>
<td>52.0 (46.1)**</td>
<td>11.9 (7.6)</td>
</tr>
<tr>
<td>3. NAWAK</td>
<td>7.9 (8.1)</td>
<td>3.6 (4.0)</td>
<td>7.4 (4.8)</td>
<td>3.6 (2.1)**</td>
<td>10.2 (3.4)</td>
<td>3.1 (2.0)**</td>
<td>5.9 (2.9)</td>
</tr>
<tr>
<td>4. WASO</td>
<td>46.2 (48.5)</td>
<td>27.4 (31.7)</td>
<td>62.7 (55.9)</td>
<td>47.8 (41.7)</td>
<td>47.9 (22.1)</td>
<td>56.2 (37.6)</td>
<td>27.7 (24.7)</td>
</tr>
<tr>
<td>5. TST</td>
<td>430.1 (69.4)</td>
<td>400.0 (107.5)</td>
<td>357.7 (78.1)</td>
<td>363.8 (68.7)</td>
<td>373.1 (40.9)</td>
<td>293.5 (76.7)**</td>
<td>420.8 (39.3)</td>
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<td>Night 2</td>
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<td>1. SE %</td>
<td>86.3 (7.1)</td>
<td>79.7 (20.4)</td>
<td>80.1 (16.5)</td>
<td>74.5 (20.9)</td>
<td>87.2 (6.8)</td>
<td>70.2 (14.9)**</td>
<td>89.4 (8.4)</td>
</tr>
<tr>
<td>2. SOL</td>
<td>23.3 (22.5)</td>
<td>21.2 (25.3)</td>
<td>24.9 (25.7)</td>
<td>43.1 (38.7)**</td>
<td>12.4 (10.3)</td>
<td>54.3 (42.3)**</td>
<td>11.8 (13.4)</td>
</tr>
<tr>
<td>3. NAWAK</td>
<td>7.0 (5.8)</td>
<td>2.0 (1.8)*</td>
<td>8.4 (7.2)</td>
<td>2.7 (2.3)**</td>
<td>9.1 (4.3)</td>
<td>2.9 (1.2)**</td>
<td>4.8 (3.1)</td>
</tr>
<tr>
<td>4. WASO</td>
<td>33.4 (28.7)</td>
<td>31.1 (59.3)</td>
<td>64.4 (67.3)</td>
<td>53.1 (55.7)</td>
<td>35.4 (23.1)</td>
<td>60.9 (27.3)*</td>
<td>25.9 (26.0)</td>
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<tr>
<td>5. TST</td>
<td>381.4 (38.4)</td>
<td>370.1 (94.9)</td>
<td>371.2 (75.3)</td>
<td>348.5 (101.2)</td>
<td>403.2 (27.1)</td>
<td>325.2 (70.8)**</td>
<td>400.5 (60.9)</td>
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<tr>
<td>Night 3</td>
<td></td>
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<tr>
<td>1. SE %</td>
<td>89.7 (8.1)</td>
<td>85.5 (14.9)</td>
<td>85.2 (9.9)</td>
<td>78.3 (16.2)*</td>
<td>85.6 (9.5)</td>
<td>65.5 (13.4)**</td>
<td>91.9 (6.1)</td>
</tr>
<tr>
<td>2. SOL</td>
<td>14.7 (12.7)</td>
<td>22.9 (15.9)</td>
<td>15.3 (16.9)</td>
<td>37.5 (31.2)**</td>
<td>11.5 (7.5)</td>
<td>41.0 (24.9)**</td>
<td>6.4 (6.9)</td>
</tr>
<tr>
<td>3. NAWAK</td>
<td>5.1 (5.2)</td>
<td>4.0 (2.9)</td>
<td>8.5 (8.5)</td>
<td>2.6 (2.0)**</td>
<td>7.3 (4.5)</td>
<td>3.3 (1.3)**</td>
<td>5.2 (5.2)</td>
</tr>
<tr>
<td>4. WASO</td>
<td>22.8 (24.8)</td>
<td>17.0 (15.3)</td>
<td>45.5 (42.3)</td>
<td>52.8 (49.1)</td>
<td>47.8 (43.1)</td>
<td>76.5 (45.2)**</td>
<td>25.3 (28.7)</td>
</tr>
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<td>5. TST</td>
<td>389.3 (66.2)</td>
<td>403.2 (90.3)</td>
<td>379.8 (35.3)</td>
<td>356.7 (72.7)</td>
<td>378.6 (52.4)</td>
<td>290.1 (58.9)**</td>
<td>405.3 (48.1)</td>
</tr>
</tbody>
</table>

*p < 0 .05, **p < 0.01.

BPD-I = Borderline individuals, Psy-I = Psychophysiological insomnia sufferers, Para-I = Paradoxical insomnia sufferers, GS = Good sleepers, SOL = Sleep onset latency in minutes, NAWAK = Number of awakenings, WASO = Wake after sleep onset in minutes, TST = Total sleep time in minutes, SE = Sleep efficiency.

Night 3. Objectively, sleep efficiency increased from Night 1 to Night 3, while a decrease from Night 1 to Night 2 was observed in time spent in stage 4 as well as in the percentage of stage 4. No other between night differences reached significance.

**DISCUSSION**

This research was first aimed at studying the sleep characteristics of BPD-I. Based on clinical observations, it was hypothesized that BPD-I would subjectively share more common characteristics with both groups of insomnia sufferers than with good sleepers. The 2 weeks of sleep diaries completed before laboratory recordings showed that sleep variables of BPD-I, Para-I, and Psy-I were similar but different from GS. Our results suggest that BPD-I suffer from chronic insomnia. Although nightmare occurrences are not available in the current study, these individuals reported sleep difficulties not linked to nightmares as confirmed during the IDI. Para-I were the group of individuals who showed the most important discrepancies between subjective estimates of sleep and objective sleep parameters, which is the group definition criterion. Unexpectedly, BPD-I showed the best concordance between subjective and objective sleep data. Since BPD-I showed no discrepancies between objective and subjective measures of sleep, they were closer in their estimations to good sleepers than to both groups of insomnia sufferers. Nonetheless, objective data from PSG recordings underline longer sleep onset, less total sleep time and lower sleep efficiency in both groups of insomnia and BPD-I compared to GS. Thus, BPD-I do not appear to show common features with Para-I insomnia sufferers more than with other groups of sleepers when studied in the sleep laboratory. Even though BPD-I spent more time in stage 4 sleep than Para-I and reported having slept better in the sleep laboratory than at home compared to other sleepers, these individuals nevertheless reported that their sleep was less refreshing and restorative than the other 3 groups of sleepers.

Many studies on insomnia have previously failed to detect or confirm sleep difficulties/complaints in laboratory settings; some studies have found that as many as 50% of patients suffering of chronic primary insomnia do not show objective evidence of insomnia when sleeping in the laboratory environment. Some earlier studies suggested that high inter-night variability may preclude an adequate circumspection of complaints if only one or two nights of PSG are evaluated. However, it was not the case in the present study. Complaints of both groups of primary chronic insomnia sufferers, according to their respective diagnosis, were confirmed by PSG measures (SOL and WASO >30 min), even though inaccurate perceptions of sleep difficulties were observed in these two groups. Again, these results suggest that both groups of primary chronic insomnia sufferers were well diagnosed and categorized according to the criteria of Edinger et al.3

The picture is less clear for BPD-I. Although subjective reports on sleep diaries and high scores on the ISI along with the clinical interview confirmed that these individuals suffered from chronic insomnia, subjective in-laboratory sleep patterns were not confirmed by objective sleep measures (although WASO was close to the arbitrary cut-off usual for maintenance insomnia (see Table 2, Night 1 and 2). A recent study by Philipsen et al. also observed few differences between objective and subjective sleep patterns in BPD-I compared to controls. As mentioned earlier, in regard to insomnia, it has been previously observed that objective sleep patterns do not always reflect the subjective complaint. Furthermore, a PSG evaluation, although characterized as a gold standard, is not recommended for the diagnosis of insomnia. One might also argue that ambulatory recordings
Table 3—Mean and (SD) of Objective Sleep Parameters for all Four Groups of Participants on Each Night

<table>
<thead>
<tr>
<th></th>
<th>% S1</th>
<th>% S1 min</th>
<th>% S2</th>
<th>% S2 min</th>
<th>% S3</th>
<th>% S3 min</th>
<th>% S4</th>
<th>% S4 min</th>
<th>% REM</th>
<th>REM min</th>
<th>Latency to REM</th>
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<tr>
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<td>(8.9)</td>
<td>205.1</td>
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<td>(5.1)</td>
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<td>(9.8)</td>
<td>55.4</td>
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<td>8.5</td>
<td>(3.7)</td>
<td>33.1 (14.5)</td>
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<tr>
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<td>16.3</td>
<td>(12.4)</td>
<td>55.8</td>
<td>(11.5)</td>
<td>198.8</td>
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<td>10.5</td>
<td>(5.5)</td>
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<td>(6.8)</td>
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<td>(7.1)</td>
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<td>(41.0)</td>
<td>9.0</td>
<td>(5.1)</td>
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<td>(6.5)</td>
<td>58.3</td>
<td>(8.6)</td>
<td>244.1</td>
<td>(34.6)</td>
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<td>(9.0)</td>
<td>246.4</td>
<td>(55.0)</td>
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<td>227.8</td>
<td>(41.0)</td>
<td>9.4</td>
<td>(5.9)</td>
<td>38.5 (25.5)</td>
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</tbody>
</table>

(Night sleep laboratory, S1 = Stage 1, S2 = Stage 2, S3 = Stage 3, S4 = Stage 4, REM = Rapid Eye Movement sleep.

*Significant differences between BPD-I and Para-I (p < 0.05)

(hom PSG) may have been more sensitive to the severity of the sleep disturbances in BPD-I. In that regard, Battaglia et al. have indeed observed that the sleep of BPD-I significantly differ from that of controls when sleep was recorded at home. These authors reported longer sleep onset latency and time awake after sleep onset, a greater number of awakenings, a reduced sleep efficiency and proportion of stage 1 sleep as well as a shorter REM latency in BPD-I compared to controls. A comparison of at-home recordings with in-laboratory recordings between our 3 groups of insomnia sufferers might confirm that indeed sleep patterns of BPD-I resemble those of either Para-I and Psy-I when recordings are conducted in natural settings (i.e., home).

As BPD-I are very sensitive to loneliness and interpersonal stressors, laboratory settings might provide a secure context facilitating sleep, and not be representative of “home” sleep. Although sleep at home might be more sensitive to sleep disturbances, it is doubtful that the most striking significant difference we observed in the present study, increased stage 4 (proportion and time) in BPD-I, would be the result of only the laboratory settings. Usually, a greater number of awakenings, more stage shifts, and an increase in lighter stages of sleep are indexes of a lesser quality of sleep. As such, a greater percentage of stage 2 sleep, as observed by Philipsen et al., might, to some limits, have been translated in subjective reports of “bad sleep” by BPD-I. In contrast, our result of increased stage 4 sleep in this group of individuals appears incongruous with their reports of having nonrefreshing and nonrestorative sleep, as well as feeling fatigued upon awakening. It is possible that a certain amount of time is spent in stage 4, or beyond a certain threshold, the adverse feeling is observed. Thus, nonrestorative sleep could be linked to a greater percentage of stage 4 in BPD-I than in Para-I, despite the observation that the amount of combined stages 3 and 4 remained within reported norms for age and gender in all groups. On the other hand, it is also possible that for BPD-I, feeling nonrestored and nonrefreshed in the morning, despite the high percentage of stage 4 sleep, might simply be part of their general constellation of symptoms or be reflective of another cognitive distortion, like those associated with the personality disorder diagnosis.

Besides an increase in stage 4 sleep for BPD-I, we did not find any other significant results for this group of individuals. Even if BPD-I displayed a greater score on the depression inventory, no indication of depression-like symptoms linked to clinical sleep measures were observed in the present study. Hence, no shortened REM latency was observed in our sample. These results are in contrast with previous studies. As mentioned earlier, even when concomitant depression was controlled for, shortened REM latency and greater REM density were observed in BPD-I compared to controls. It was thus suggested that BPD-I shared common sleep and biological features with severe depression sufferers. Our sample of BPD-I, even with severe complaints and marked distress regarding sleep difficulties and with high scores on the BDI, was very “clean.” In that regard, BPD-I were drug-free and did not present any severe psychopathologies. Consequently, our sample of individuals might not have been representative of the severity of clinical symptoms and drug intake in previous studies. It is possible that not being that severely “disordered” precludes these depression-like sleep clinical indices.

It is also possible that PSG alone, although the gold standard in sleep research, is not sensitive enough to circumscribe the nature of the sleep complaints in BPD-I. As mentioned earlier, not all insomnia sufferers’ complaints are corroborated with PSG. In that regard, the quantitative analyses of the EEG with PSA, have shown that individuals with psychophysiological insomnia display greater activity in fast-frequency EEG activity bands, notably in the β range than good sleepers. Although few data have been reported with Para-I, these individuals appear to display even greater absolute activity in fast-frequency bands than Psy-I. The increased activity in fast-frequency bands might be reflective of a hyperarousal state in those with insomnia.

In BPD-I, compared with controls, Philipsen et al. recently showed an increase in δ power in total NREM sleep and across all NREM cycles. Unfortunately, PSA was not applied in the present study. Although an increase in stage 4 sleep might not necessarily reflect an increase in δ power, applying PSA to our sleepers’ EEG might concur with the data of Philipsen et al. Furthermore, applying PSA to our
Despite these interesting results, the present study has some limits. First, the sample was quite small. It is possible that increasing sample size might have targeted only individuals displaying the less severe ends of continuums to better represent the general population. Furthermore, a study comparing medicated and unmediated BPD-I could also provide information on sleep perception. In that regard, it is has long been observed that medication, especially benzodiazepines, modifies the perception of sleep in insomnia sufferers. These individuals report being awake less often than being asleep once awakened after a sleep spindle, while the opposite is most often observed with drug-free individuals. Future research should also aim at comparing the microstructure of sleep between groups. These comparisons might help understanding why BPD-I report nonrestorative sleep while displaying an increased amount of stage 4. Finally, the hypothesis of sleep pressure has been put forward for insomnia sufferers, and this interesting question remains to be answered.

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DISCLOSURE STATEMENT

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REFERENCES


