BEHAVIORAL SLEEP MEDICINE, *1*(3), 140–154

Impact of Imagery Rehearsal Treatment on Distressing Dreams, Psychological Distress, and Sleep Parameters in Nightmare Patients

Anne Germain
Department of Psychology
University of Montreal

Tore Nielsen
Department of Psychiatry
University of Montreal

We investigated the impact of imagery rehearsal treatment (IRT) on nightmare frequency, psychological distress, and sleep quality using polysomnography (PSG). 12 chronic nightmare patients completed prospective dream logs, measures of psychological distress, and underwent PSG prior to and 8.5 weeks following a single IRT session. Post-treatment, significant reductions were observed in retrospective nightmare frequency ($d = 1.06$, $p = .007$), prospective bad dream frequency ($d = 0.53$, $p = .03$), and anxiety scores ($d = 1.01$, $p = .004$). Minimal sleep alterations were found post-IRT, and varied as a function of nightmare etiology. The results independently replicate the efficacy of IRT for alleviating disturbing dreams and psychological distress. Sleep improvement may occur later in the recovery process.

Nightmares are a prevalent problem, affecting 4–8% of the general population (Bixler, Kales, Soldatos, Kales & Healy, 1979; Klink & Quan, 1987). Nightmares occurring because of exposure to a trauma (i.e., posttraumatic nightmares), and nightmares unrelated to trauma, medical, or psychiatric disorders that occur in childhood and persist into adulthood (i.e., idiopathic nightmares) constitute two

Requests for reprints should be sent to Anne Germain, Department of Psychiatry, University of Pittsburgh School of Medicine, 3811 O'Hara Street, E–1116, Pittsburgh, PA 15213. E-mail : germaina@msx.upmc.edu

common forms of distressing dreams. A growing body of research indicates that patients with posttraumatic and idiopathic nightmares also suffer from sleep disturbances such as increased sleep onset latency (SOL), more time awake after sleep onset, more frequent nocturnal awakenings, more body movements during sleep, and greater difficulty returning to sleep after awakening from a nightmare (e.g., 1990; Krakow et al., 2000; Levin, 1994).

Imagery rehearsal treatment (IRT) is a cognitive-behavioral intervention focusing on nightmare alleviation that has been shown to reduce posttraumatic and idiopathic nightmare frequency markedly within 6 to 12 weeks of treatment (e.g., Kellner, Neidhardt, Krakow & Pathak, 1992; Krakow, Hollifield, et al., 2001; Neidhardt, Krakow, Kellner, & Pathak, 1992). These findings, however, are derived from retrospective nightmare frequency measures, which produce estimates that are much lower than those collected with prospective home logs in both healthy patients (Wood & Bootzin, 1990; Zadra & Donderi, 2000) and sexual abuse survivors (Penn, Bootzin, & Wood, 1992). Additionally, there is growing evidence for a phenomenological distinction between nightmares (i.e., unpleasant dreams that awaken the sleeper) and bad dreams (i.e., unpleasant dreams that do not awaken the sleeper; Zadra & Donderi, 2000). Specifically, nightmares are associated with more psychological distress than are bad dreams (Zadra & Donderi, 2000), and only 25% of chronic nightmare sufferers always awaken from their unpleasant dreams (Krakow, Tandberg, Scriggins, & Barey, 1995). Whether IRT reduces both nightmares and bad dreams is a problem that remains unexplored, but hinges on whether IRT influences either or both the emotional (i.e., negative affect) or behavioral (i.e., awakening) components of disturbing dreams.

Significant reductions in psychological distress and improvements in sleep quality have been reported following nightmare alleviation with IRT (e.g., Kellner et al., 1992; Krakow, et al., 1995; Krakow, Hollifield, et al., 2001; Neidhardt et al., 1992). Only one study of 12 war veterans completing prospective dream logs has independently replicated the findings of reduced nightmare frequency and improved psychological distress following IRT (Forbes, Phelps, & McHugh, 2001). However, in this work a definition of nightmares was not provided, and the specific effect of IRT on subjective sleep complaints was not reported. More generally, no study has yet investigated the impact of IRT on sleep quality using objective polysomnographic (PSG) measurements.

The goals of this study were (a) to determine the effects of IRT on the frequency of both nightmares and bad dreams using prospective dream logs, (b) to replicate the finding of decreased psychological distress following IRT, and (c) to investigate the effects of IRT on sleep using PSG recordings. We hypothesized that IRT would alleviate nightmares, bad dreams, psychological distress, and improve quality and consolidation of sleep. An additional exploratory goal was to investigate whether patients suffering from posttraumatic nightmares (P-NM) and idiopathic nightmares (I-NM) respond differentially to this form of treatment.

METHOD

Patients

Nightmare patients were recruited from advertisements that appeared in the Université de Montréal's campus newspaper, and from callers who had seen a short televised documentary on the laboratory study of nightmares that was presented during prime time news. To enter the study, patients had to be at least 18 years of age and had to report recalling more than one nightmare per week for a minimum of 6 months. Patients were excluded if (a) they were currently taking medications known to influence sleep and dreams, (b) they were currently suffering from a major psychiatric disorder other than posttraumatic stress disorder (PTSD), (c) they were currently suffering from another major sleep disorder (e.g., obstructive sleep apnea, narcolepsy), (d) they were diagnosed with a neurological disorder, (e) they reported using or abusing alcohol or drugs on a regular basis, (f) they reported irregular sleep-wake schedules or having undergone jet lag in the previous three months, or (g) they were currently engaged in legal proceedings involving events related to their nightmares or trauma. Twelve nightmare patients met these criteria and participated in the study. Six suffered chronic PTSD and nightmares (P-NM; 4 men and 2 women, *M* age = 41.5 ± 10.7 years, age range = 28–58) and six met criteria for Nightmare Disorder (American Psychiatric Association [APA], 1994), or idiopathic nightmares (I-NM; 3 men and 3 women; *M* age = 27.2 ± 5.8 years, age range = 19–36). PTSD status was determined using the Posttraumatic Symptom Scale (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993) and the Clinician's Assessment of Posttraumatic Stress (Blake et al., 1993). Mean PTSD chronicity was 11.3 ± 9.8 years (range = 3–25 years). Trauma occurred in childhood for two of the P-NM patients. I-NM patients were significantly younger than P-NM patients ($M = 27.0 \pm 5.8$ and $M = 41.0 \pm 10.5$ respectively; $t\,(10) = 2.84$, $p = .02$), but I-NM and P-NM patients did not differ on nightmare chronicity ($M = 19.0 \pm 20.9$ and $M = 22.3 \pm 7.7$ respectively; $t\,(10) = -0.36$, $p = .72$). Two of the I-NM patients also reported having experienced traumatic events (one experienced the trauma in childhood), but the onset of nightmares was determined to precede the trauma in both cases, and neither met the criteria for past or current PTSD. Three of the P-NM patients met the criteria for a current depressive episode in the severe range. However, the depressive symptoms were attributable to PTSD-related events (i.e., financial problems, social isolation, and imminent prison release of the aggressor) and the patients were thus included. One I-NM patient and none of the P-NM patients reported a prior history of substance abuse. The Sacré-Coeur Hospital Ethics Committee approved the study. Written consent was obtained from all patients.

Retrospective and Prospective Measures of Disturbing Dream Events

A retrospective estimate of nightmare frequency (nightmares per week for the previous month) was obtained for all patients at intake, and again just prior to the post-treatment sleep evaluation. Retrospective nightmare estimates were derived from one item on an investigator-designed general questionnaire asking about the frequency of awakenings associated with the recall of a disturbing dream. Retrospective frequency estimates of bad dreams and sleep terrors were not available.

For the 15 days prior to sleeping in the laboratory, all patients completed a daily home dream log in which they indicated the number of dreams, nightmares (unpleasant dreams that awakened them), and bad dreams (unpleasant dreams that did not immediately awaken them) they recalled upon awakening. Because sleep terrors have been reported in traumatized patients (e.g., Fisher, Byrne, Edwards, & Kahn, 1970), the frequency of sleep terrors (sudden awakenings accompanied by intense feelings of panic and minimal dream content recall) was also measured prospectively. All events were described to patients when they received the dream logs, with written definitions also provided in the logs. Patients were instructed to write down the last dream they recalled upon awakening, whether this dream was unpleasant or not. Questions regarding frequency of disturbing nocturnal events were embedded in items regarding use of medications and caffeine, exercise level on the previous day, bedtime and wakeup times, sleep quality, number of nocturnal awakenings, and total number of recalled dreams upon awakenings. Patients were informed that the purpose of the dream log was to acquire information on their waking and sleep patterns while in the home environment. The same log was completed again for 15 days preceding the post-treatment laboratory sleep recordings. From these logs, weekly estimates for nightmares, bad dreams, and sleep terrors were calculated as the total number of events recorded (out of the 15 nights) prorated to a weekly baseline.

Measures of Subjective Distress

At intake and just prior to the post-treatment sleep evaluation, patients filled out the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, &, Erbaugh, 1961), the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988), and the Nightmare Distress Questionnaire (NDQ; Belicki, 1992). The BDI is a 21-item self-report questionnaire that assesses severity of the behavioral, cognitive, emotional and somatic symptoms associated with depression. The BAI is a similar 21-item self-report checklist that assesses the severity of anxiety-related

symptoms. Good psychometric properties have been demonstrated for both inventories (Beck, Epstein, et al., 1988; Beck, Steer, & Garbin, 1988). Both the BDI and the BAI are scored by summing responses for each of the 21 items, with each item rated on a 0–3 scale. A higher score indicates a higher level of depression or anxiety. The NDQ is a 13-item self-report scale that measures the level of waking distress associated with the experience of nightmares. This instrument has been shown to be reliable; high scores are significantly correlated with interests in pursuing therapy for nightmares (Belicki, 1992). Finally, patients who reported that the onset of their nightmares followed a traumatic experience completed the PSS (Foa et al., 1993), which measures PTSD symptoms according to DSM-III-R criteria and evaluates the severity of intrusion, avoidance, and arousal symptoms in the preceding two-week period. On all four measures, higher scores reflect greater symptom severity.

Polysomnography

After completing the pre- and post-IRT 15-day dream logs, all patients slept in the laboratory for PSG recordings for two consecutive nights. PSG1 was conducted prior to treatment and PSG2 was conducted 6 to 14 weeks after the IRT session ($M = 8.5 \pm 3.4$ weeks). Each PSG was performed with a 25-channel montage measuring EEG with the International 10–20 system of electrode placements (FP1, FP2, F3, Fz, F4, F7, F8, C3, Cz, C4, T3, T4, T5, T6, P3, Pz, P4, O1, O2; Jasper, 1958), eye movements (LOC-A2; ROC-A1), EMG (submental and right tibialis), oral-nasal thermistor, and ECG. A referential montage with linked-ear reference (A1+A2) and a 10K-Ohms resistance was used for recording the 19 EEG channels. Signals were acquired using Rhythm Software version 10.0 (Stellate System, 1995).

Sleep stages were scored manually according to Rechtschaffen and Kales (1968) by an experienced PSG technician using Harmony version 4.1 Software (Stellate System, 1999); this technician did not conduct the sleep recordings and was blind to the goals of the study. SOL was computed as the interval between lights out and the first episode of sleep. Periodic leg movements (PLMs) were scored according to Coleman's (1982) criteria. Rapid-eye movement (REM) density was computed as the number of REMs for each of the last five min of each REM sleep episode; an average REM density per min for the first four REM periods was calculated (Tachibana et al., 1992). Arousals were defined as abrupt changes in EEG frequency, which could include alpha or theta frequencies but not spindles, with a minimal duration of 3 s, a maximal duration of 10 s, and a minimal interval of continuous sleep of 10 s (American Sleep Disorders Association [ASDA], 1992). An arousal index was computed which reflected the number of arousals per hr of sleep.

The first night was an adaptation night; only results collected from the second night were assessed. Bedtime was between 22:00 and midnight depending on the pa-

tient's usual bedtime, and the morning awakening was conducted between 06:00 and 08:00, again, depending on the patient's typical schedule. In the morning, electrodes were removed and patients were free to go for the day. Prior to leaving the laboratory after the first recording night, they were reminded to avoid caffeine consumption and naps during the day in preparation for the second recording night. All patients received a monetary compensation of $20 per night slept in the laboratory.

Nightmare Treatment Session

Patients underwent one IRT session conducted in a small group format ($N = 2–5$) that took place within two weeks of PSG1. Although IRT has been recently been administered in two- to three-session treatment programs that include sleep hygiene training (Krakow, Hollifield, et al., 2001; Krakow, Johnson, et al., 2001), prior studies indicate that single IRT sessions focusing on nightmares also effectively reduce nightmares (Kellner et al., 1992; Neidhardt et al., 1992). Because the primary goal of the study was to assess the impact of IRT on sleep, a single treatment session focusing on nightmares was selected to avoid the potential confounding effects of sleep hygiene education on sleep quality post-treatment. This three-hour session consisted of two parts: (a) Patients were given information regarding the prevalence of nightmare complaints and the possible causes of nightmares, and they were encouraged to ask questions about nightmares; (b) the rationale for IRT was presented, and the technique was introduced and practiced once in the group. Specifically, patients were first instructed to choose a nightmare they had had, and to write it down in the first person, present tense. To facilitate acquisition of the technique while minimizing occurrences of intrusive unpleasant images during practice, they were instructed to avoid selecting their worst nightmares or nightmares that were replays of real life events. They were then instructed to change their initial nightmare in any way they wished, so that the new version would be neither unpleasant nor distressing, and to write down the new version of the dream. Then, a 5-min period was allotted for imaginal rehearsal of the new dream. After questions and methods for dealing with intrusive images during rehearsal were discussed, patients were told to practice a new dream at home, at least once a day, every day, for the next 4–6 weeks. They were instructed to practice no more than two new dreams per week. Mastery of the technique was assessed immediately after initial exposure during the treatment session and during telephone interviews three weeks post-treatment. Patients were also instructed to call the investigators at any time for questions and if they experienced difficulty during IRT practice sessions.

Statistical Analyses

Paired *t*-tests were used to compare pre- and post-IRT scores. To minimize Type I errors, Bonferroni corrections were applied for each set of variables (i.e., dream

events, psychological distress, and sleep measures). For the total sample, corrected statistical levels of significance were: $p < .01$ for dream events (.05/4); $p < .02$ for measures of psychological distress (.05/3); and $p < .004$ for sleep measures (.05/14). Pre- to post-treatment comparisons within the P-NM and I-NM subgroups of nightmare sufferers were also computed. Because of the small sample size in these subgroups (i.e., $n = 6$), Bonferroni corrections were not applied to these pre- to post-treatment comparisons. Assumptions of homogeneity of variance and distribution normality were assured by applying logarithmic and square root transformations to sleep measures prior to conducting statistical comparisons. Statistica 5.1 software (StatSoft, 1996) was used for analyses. The impact of IRT was further quantified with Cohen's *d* effect sizes (Cohen, 1988) using pooled standard deviations. A Cohen's *d* value of .20 reflects a small effect size, a value of .50 represents a medium effect size, and a value equal to or above 0.80 indicates a large effect size. Positive *d* values indicate improvements in pre- to post treatment scores, whereas negative *d* values indicate worsening.

RESULTS

Impact of IRT

Results depicting the impact of IRT on retrospective and prospective estimates of dream events are shown in Table 1. There was a significant post-treatment reduction in the retrospective nightmare frequency estimate ($t(11) = 3.33, p < .01$), and a tendency for reduction in the prospective bad dream frequency estimate ($t(11) = 2.69, p = .03$). Prospective estimates of nightmares and sleep terrors did not differ pre- to post-IRT, however, medium to large effect sizes indicated significant reductions in retrospective estimates of nightmare frequency ($d = 1.60$) and prospective estimates of bad dreams ($d = .53$) and sleep terrors ($d = 0.78$) post-treatment. IRT had minimal impact on the prospective estimate of nightmare frequency ($d = -.12$).

Results concerning the impact of IRT on psychological distress are presented in Table 2. Symptoms of anxiety were significantly reduced post-IRT ($t(11) = 3.64, p < .02$). A tendency for reduced nightmare distress was also observed ($t(11) = 2.57, p = .03$). Nevertheless, medium to large Cohen's *d* effect sizes indicated that all symptoms of psychological distress were substantially reduced post-IRT.

Pre-treatment, nightmare sufferers did not exhibit gross sleep anomalies. Mean total sleep time (TST), SOL, and sleep efficiency (SE; ratio of total time asleep/time spent in bed) were respectively: 355.7 ± 39.5 min; 17.3 ± 17.9 min; and 87.3% + 10.5%. The mean arousal index was also within norms for this age range ($M = 8.2 \pm 4.8$ arousal/hr; Boselli, Parrino, Smerieri, & Terzano, 1998). Post-treatment, none of the objective sleep measures differed statistically. A small effect size for TST ($d = .42$) indicated a slight increase in TST post-IRT ($M = 372.5$

TABLE 1
Weekly Frequency Estimates of Dream Events and *t* Tests and Cohen's *d* Effect Sizes for Reported Pretreatment–Posttreatment Comparisons for All Nightmare Patients and for the Two Subgroups

	All NM[a]						*P–NM*[b]						*I–NM*[b]					
	Pre-IRT		*Post-IRT*				*Pre-IRT*		*Post-IRT*				*Pre-IRT*		*Post-IRT*			
	M	*SD*	*M*	*SD*	*d*	*t(11)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*
Retrospective nightmares	3.0	1.7	1.3	1.5	1.06	3.33*	3.0	2.1	1.5	1.6	.80	1.71	3.2	1.4	1.1	1.5	1.45	3.14
Prospective nightmares	3.2	3.2	3.6	4.3	–0.12	1.55	2.4	1.0	3.3	2.5	–.47	–0.68	3.3	4.2	3.4	6.0	–0.02	–0.88
Prospective bad dreams	6.4	6.3	3.7	3.5	0.53	2.69	9.5	7.7	4.6	3.6	.82	2.23	3.7	2.3	3.2	3.3	2.84	6.87
Prospective sleep terrors	0.5	0.9	0.0	0.0	0.78	1.73	0.4	0.6	0.0	0.0	.95	1.34	0.5	1.1	0.0	0.0	0.64	1.00

Note. NM = all nightmare patients; P–NM = patients with posttraumatic stress disorder and nightmares; I–NM = idiopathic nightmare patients; IRT = imagery rehearsal treatment.

[a]$n = 12$. [b]$n = 6$.

*$p < .01$.

TABLE 2
Measures of Psychological Distress and t Tests and Cohen's *d* Effect Sizes for Pretreatment–Posttreatment Comparisons for All Nightmare Patients and for the Two Subgroups

	All NM[a]						*P–NM*[b]						*I–NM*[b]					
	Pre		*Post*				*Pre-IRT*		*Post-IRT*				*Pre-IRT*		*Post-IRT*			
	M	*SD*	*M*	*SD*	*d*	*t(11)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*
Anxiety	15.1	10.0	6.8	6.0	1.01	3.64**	16.8	6.6	7.8	6.9	1.33	3.35*	16.0	2.5	6.6	5.5	2.20	2.15
Depression	15.5	8.7	8.8	8.2	0.79	2.12	20.2	8.6	13.3	9.2	0.77	1.08	11.8	6.5	4.2	4.3	1.38	3.77*
Nightmare distress	38.7	7.1	28.9	13.7	0.90	2.57	40.0	7.0	30.7	16.3	0.74	1.84	39.0	7.0	26.6	13.1	1.18	0.45
PTSD severity[c]							35.0	8.4	16.7	12.4	1.73	3.16*						

Note. NM = all nightmare patients; P–NM = patients with posttraumatic stress disorder and nightmares; I–NM = idiopathic nightmare patients; IRT = imagery rehearsal treatment; PTSD = posttraumatic stress disorder.

[a]$n = 12$. [b]$n = 6$. [C]Only patients with posttraumatic nightmares completed the Posttraumatic Symptom Scale.

*p £ .02. **p <<.01.

± 40.0 min). IRT was not associated with any other sleep improvements. Rather, a slight increase in the arousal index ($M = 9.8 \pm 5.7$; $d = -.30$) was observed. The latter was accompanied by a slight increase in percent of stage 2 sleep (%S2; from $M = 62.0 \pm 7.1\%$ to $M = 63.5 \pm 7.7\%$; $d = .20$) and a slight reduction in percent of stage 3 sleep (%S3; from $M = 7.3 \pm 5.2\%$ to $M = 5.2 \pm 4.0\%$; $d = –.44$) post-IRT. IRT had negligible effects on other sleep parameters including REM sleep measures (Table 3).

Impact of IRT Within Subgroups of Nightmare Patients

All but one P-NM patient reported fewer nightmares post-treatment; the one exception reported more nightmares. Five I-NM patients reported fewer nightmares, and one reported no change. Tables 1 and 2 include pre- and post-IRT mean scores and effect sizes for the two subgroups of nightmare patients. Despite substantial reductions in retrospective nightmare frequency and in prospective frequency of bad dreams and sleep terrors in both subgroups, no statistically significant differences were observed. Nevertheless, for both P-NM and I-NM patients, large to medium effect sizes reflecting substantial reductions in retrospective estimates of nightmare frequency ($d = 1.87$ and 1.45 respectively), and in prospective estimates of bad dreams ($d = .82$ and 2.84) and sleep terrors (d = 0.95 and 0.64) were found. Medium to large effect sizes were also observed on measures of psychological distress in both subgroups of nightmare patients (Table 2). Specifically, P-NM and I-NM patients endorsed less severe anxiety ($d = 1.33$ and 2.20 respectively), depression ($d = .77$ and 1.38) and nightmare distress ($d = .74$ and 1.18). For P-NM patients, IRT was associated with considerable reductions in posttraumatic symptom severity, as indicated by the large effect size of 1.73.

The effects of IRT on sleep measures post-treatment were surprising for both subgroups. For P-NM patients, small effect sizes indicated a slight increase in SOL (from $M = 10.8 \pm 9.6$ min to $M = 15.1 \pm 16.9$ min; $d = –.31$), on the arousal index (from $M = 9.8 \pm 5.7$ to $M = 12.6 \pm 6.1$; $d = –.47$), %S3 (from $M = 4.4 \pm 4.4\%$ to $M = 3.3 \pm 2.6\%$; $d = –.30$), and percent of stage 4 sleep (from $M = .3 \pm .4\%$ to $M = .2 \pm .4\%$; $d = –.25$). In other words, P-NM patients demonstrated longer SOL and less slow-wave sleep post-IRT. Table 3 presents pre- to post-mean values for REM sleep parameters. A small effect size was observed for REM density ($d = .42$) and REM latency ($d = .38$), whereas a large effect size was found for percent of REM sleep (%REM; $d = .93$). For I-NM patients, a very different pattern of changes was observed. A small effect size reflected a reduction in SOL post-IRT (from $M = 20.8 \pm 23.0$ min to $M = 16.0 \pm 16.9$ min; $d = .24$), and a large effect size was observed for TST (from $M = 295.6 \pm 128.7$ min to $M = 375 \pm 43.5$ min; $d = .83$), indicating that post-IRT, I-NM patients fell asleep more rapidly and slept longer post-treatment. However, small to medium effect sizes also indicated an increase in wake time after sleep onset (WASO; from $M = 32.5 \pm 16.4$ min to $M = 43.1 \pm 42.5$ min; $d =$

TABLE 3
Values of REM Sleep Parameters and t Tests and Cohen's *d* Effect Sizes for Pretreatment–Posttreatment Comparisons for All Nightmare Patients and for the Two Subgroups

	All NM[a]						*P–NM*[b]						*I–NM*[b]					
	Pre-IRT		*Post-IRT*				*Pre-IRT*		*Post-IRT*				*Pre-IRT*		*Post-IRT*			
	M	*SD*	*M*	*SD*	*d*	*t(11)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*	*M*	*SD*	*M*	*SD*	*d*	*t(5)*
% REM	18.6	3.9	19.1	7.3	–.09	–0.29	16.90	1.9	20.30	4.8	–.93	–0.29	18.1	9.0	20.2	5.9	–.28	–.14
REM latency	84.5	27.1	85.7	32.4	–.04	0.92	80.72	14.4	70.88	33.6	.38	0.92	88.3	37.2	100.5	52.5	–.13	–.59
REM density	6.4	6.8	7.0	4.6	.10	–2.43	6.60	5.4	8.80	5.1	–.42	–2.43	6.1	8.6	5.0	3.1	.17	.14

Note. Mean values and standard deviations are presented in original units. Square root transformations were performed before analyses of the arousal indexes. REM = rapid eye movement. NM = all nightmare patients; P–NM = patients with posttraumatic stress disorder and nightmares; I–NM = idiopathic nightmare patients; IRT = imagery rehearsal treatment.

[a]$n = 12$. [b]$n = 6$.

–.34); and number of awakenings (from $M = 22.5 \pm 11.4$ min to $M = 25.3 \pm 11.9$ min; $d = -.27$). These slight increases in the number and duration of nocturnal awakenings were accompanied by decreases in SE (from $M = 91.6 \pm 4.0\%$ to $M = 90.2 \pm 8.8\%$; $d = -.20$), an increase in %S2 (from $M = 59.0 \pm 7.9\%$ to $M = 62.5 \pm 8.3\%$; $d = .43$) and a decrease in %S3 (from $M = 10.2 \pm 5.4\%$ to $M = 7.1 \pm 4.4\%$; $d = -.63$). A small effect size was also found for % REM ($d = .28$), indicating a small increase in %REM sleep post-IRT.

DISCUSSION

Although the relatively small sample size limited statistical power of this study, effect sizes indicated clinically significant reductions in retrospective nightmare frequency, prospective frequency of bad dreams, as well as symptoms of psychological distress in a group of chronic nightmare patients. Both subgroups of nightmare patients also exhibited significant improvements on these measures. Prospective nightmare frequency, however, remained unaltered. IRT may reduce infrequent sleep terrors, but this finding remains to be replicated in individuals with frequent sleep terrors. For the total sample, PSG measurements did not show statistically significant improvements in sleep quality. However, results provide preliminary indications that the effect of IRT on sleep may vary as a function of nightmare etiology.

Bad dreams (i.e., unpleasant dreams without awakenings) and psychological distress, but not nightmares (i.e., bad dreams with awakenings) and nocturnal arousals were reduced post-treatment. These findings suggest that IRT may influence emotional systems underlying both disturbing dreaming and psychological distress, rather than the mechanism involved in nocturnal awakenings. The current DSM-IV operational definition of nightmares as "repeated awakenings from the major sleep period or naps with detailed recall of extended and extremely frightening dreams" (APA, 1994, p. XX), which focuses on awakenings rather than the affective component of disturbing dreams may lead to an under-evaluation of the psychological components of the pathology. The observation that nightmare sufferers reported a slight increase in the number of nightmares prospectively most likely reflects an increase in the number of arousals during sleep post-treatment, which may have facilitated dream recall in general, and thus, nightmare recall.

Pre-IRT, nightmare patients did not demonstrate gross sleep anomalies. Mean SOL, SE, and the arousal index were within normal ranges. PSG-based measures of sleep quality demonstrated no significant improvements post-IRT despite observed reductions in distressing dreams and improvements in psychological distress. The results are consistent with a recent study that demonstrated that the pharmacological treatment of nightmares reduced nightmare frequency and improved psychological distress in posttraumatic patients despite the lack of significant PSG-confirmed improvements (Gillin et al., 2001). The lack of significant sleep

improvements may reflect the lack of PSG markers of an emotional dysregulation possibly underlying bad dreams and psychological distress. Alternatively, objective improvements in sleep parameters may appear only later in the recovery process. The clinical significance of the observed increase in arousals post-treatment in both nightmare subgroups is unclear. Nevertheless, arousal indexes pre- and post-treatment were within normal ranges (Boselli et al., 1998). Replication of this study in larger samples using longer-term follow-up assessments may elucidate the functional correlates of the observed increases in nocturnal arousals in both subgroups of nightmare sufferers.

This study provides preliminary indications that the impact of IRT on sleep may vary as a function of nightmare etiology. In P-NM patients, the increase in arousals paralleled REM sleep enhancement post-IRT, a finding consistent with Stickgold's (2002) suggestion that REM sleep facilitates emotional processing in PTSD. In P-NM patients, IRT may enhance emotional processing during sleep, which in turn, may be accompanied by heightened arousal. In I-NM patients, considerable effect sizes on REM sleep parameters were not observed post-IRT. Rather, these patients exhibited shorter SOL and longer TST, indicating slight improvements in sleep quality post-IRT. The differential effects of IRT in subgroups of nightmare patients requires replication in larger samples to identify the mechanisms underlying the relationship between nightmare etiology, distressing dreams, nocturnal awakenings, and their impact on the outcome of IRT.

Limitations of the study must be acknowledged. First, the small sample size and the consequent lack of statistical power limit the robustness of the findings. However, at least one other independent replication study with a comparably small sample (Forbes et al., 2001) reported improvements in distressing dreams (prospectively measured) and psychological distress following IRT, indicating that these effects may indeed be reliable. Replications with larger samples are required to determine more definitively the impact of IRT on sleep. Less stringent selection criteria are also necessary to insure generalizability of the results. In addition, larger samples will provide the statistical power necessary to investigate the contribution of other factors such as age and nightmare chronicity in moderating the effects of IRT on sleep. A second limitation concerns the lack of prospective measurements of IRT adherence. Although IRT mastery was assessed three weeks after the treatment session, we cannot speculate about the contributions of duration, frequency and quality of IRT practice in modulating the effects of IRT in the present study. Third, only one post-treatment assessment was conducted. Improvements in nightmare frequency, psychological distress, and sleep quality may demonstrate divergent temporal patterns. Repeated follow-up sleep assessments are necessary to better describe the impact of IRT on these three dimensions. Refined methods for studying sleep, such as power spectral analysis and functional neuroimaging, will provide further insight into the mechanisms underlying the impact of IRT on disturbed dreaming, waking psychological distress, and sleep disruption in nightmare patients.

ACKNOWLEDGMENTS

This research was supported by the Canadian Institutes of Health Research and the Fonds de la Recherche en Santé du Québec. There is no financial involvement in any organization with a direct commercial interest, off-label, or investigational use discussed in this article.

Special thanks to Sonia Frenette, Sébastien Saucier, Benoit Adam, and Stéphanie Barbier for their technical support.

REFERENCES

American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington, DC: Author.

American Sleep Disorders Association (1992). EEG arousals: Scoring rules and examples. A preliminary report from the Sleep Disorders Atlas Task Force of the American Sleep Disorders Association. *Sleep, 15*, 174–184.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. (1988). An inventory for measuring clinical anxiety. *Journal of Consulting and Clinical Psychology, 56*, 893–897.

Beck, A. T., Steer, R., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review, 8*, 77–100.

Beck, A. T., Ward, C., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561–571.

Belicki, K. (1992). Nightmare frequency versus nightmare distress: Relations to psychopathology and cognitive style. *Journal of Abnormal Psychology, 101*, 592–597.

Bixler, E., Kales, A., Soldatos, C., Kales, J., & Healy, S. (1979). Prevalence of sleep disorders in the Los Angeles Metropolitan Area. *American Journal of Psychiatry, 136*, 1257–1262.

Blake D. K., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Klauminzer, G., Charney, D. S., et al. (1990). A clinician rating scale for assessing current and lifetime PTSD: The CAPS-1. *Behavior Therapist, 13*, 187–188.

Boselli, M., Parrino, L., Smerieri, A., & Terzano, M. G. (1998). Effect of age on EEG arousals in normal sleep. *Sleep, 21*, 351–357.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). Hillsdale, NJ: Lawrence Earlbaum Associates, Inc.

Coleman R. M. (1982). Periodic limb movements in sleep (nocturnal myoclonus) and restless leg syndrome. In C. Guilleminault (Ed.), *Sleeping and waking disorders: Indications and techniques*. Melo Park, XX: Addison Wesley.

Fisher, C., Byrne, J., Edwards, A., & Kahn, E. (1970). A psychophysiological study of nightmares. *Journal of the American Psychoanalytic Association, 18*, 747–1782.

Foa, E., Riggs, D., Dancu, C., & Rothbaum, B. (1993). Reliability and validity of a brief instrument for assessing posttraumatic stress disorder. *Journal of Traumatic Stress, 6*, 459–473.

Forbes, D., Phelps, A., & McHugh, T. (2001). Treatment of combat-related nightmares using imagery rehearsal: A pilot study. *Journal of Traumatic Stress, 14*, 433–442.

Gillin, J. C., Smith-Vaniz, A., Schnierow, B., Rapaport, M. H., Kelsoe, J., Raimo, E., et al. (2001). An open-label, 12-week clinical and sleep EEG study of nefazodone in chronic combat-related posttraumatic stress disorder. *Journal of Clinical Psychiatry, 62*, 789–96.

HARMONY version 4.1.(1999). Stellate System Enr., Montréal, Québec, Canada.

Jasper, H. (1958). The 10–20 electrode system of the International Federation. *Electroencephalography and Clinical Neurophysiology, 10*, 370–375.

Kellner, R., Neidhardt, E. J., Krakow, B., & Pathak, D. (1992). Changes in chronic nightmares after one session of desensitization or rehearsal instructions. *American Journal of Psychiatry, 149*, 659–663.

Klink, M., & Quan, S. (1987). Prevalence of reported sleep disturbances in a general adult population and their relationship to obstructive airways diseases. *Chest, 91*, 540–546.

Krakow, B., Germain, A., Tandberg, D., Hollifield, M., Schrader, R., Koss, M., et al. (2000). Sleep breathing and movement disorders masquerading as insomnia in sexual-assault survivors. *Comprehensive Psychiatry, 41*, 49–56.

Krakow B., Hollifield, XX, Jonhson, L., Koss, M., Shrader, R., Warner, T.D., et al. (2001). A randomized controlled study of imagery rehearsal therapy for chronic nightmares in sexual assault survivors with posttraumatic stress disorder. *Journal of the American Medical Association, 286*, 537–545.

Krakow, B., Johnston, L., Melendrez, D., Hollifield, M., Warner, T. D., Chavez-Kennedy, D., et al. (2001). An open-label trial of evidence-based cognitive behavior therapy for nightmares and insomnia in crime victims with PTSD. *American Journal of Psychiatry, 158*, 2043–2047.

Krakow, B., Tandberg, D., Scriggins, L., & Barey, M.(1995). A controlled comparison of self-rated sleep complaints in acute and chronic nightmare sufferers. *Journal of Nervous and Mental Disease, 183*, 623–627.

Levin, R. (1994). Sleep and dreaming characteristics of frequent nightmare subjects in a university population. *Dreaming, 4*, 127–137.

Neidhardt, E. J., Krakow, B., Kellner, R., & Pathak, D. (1992). The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep, 15*, 470–473.

Penn, P. E., Bootzin, R. R., & Wood, J. M. (1992). Nightmare frequency in sexual abuse survivors. *Sleep Research, 20*, 313.

Rechtschaffen, A., & Kales, A. (1968). *A Manual for Standardized Terminology, Techniques and Scoring System for Sleep stages of human Subjects*. Los Angeles, CA: UCLA Brain Information Service, Coleman.

RHYTHM version 10.1. (1996). Stellate Systems Enr., Montréal, Québec, Canada, 1995.Statistica version 5.1 for Windows. StatSoft, Inc. Tulsa, OK.

Stickgold, R. (2002). EMDR: A putative neurobiological mechanism of action. *Journal of Clinical Psychology, 58*, 61–75

Tashibana, N., Sugita, Y., Terashima, K., Teshima, Y., Shimizu, T., & Hishikawa, Y. (1992). *Neurology, 42*, 1371–1374.

Wood, J. M., & Bootzin, R. R. (1990). The prevalence of nightmares and their independence from anxiety. *Journal of Abnormal Psychology, 99*, 64–68.

Zadra, A., & Donderi, D. C. (2000). Nightmares and bad dreams: Their prevalence and relationship to well-being. *Journal of Abnormal Psychology, 109*, 273–281.