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INCREASED LUCID DREAMING FREQUENCY IN NARCOLEPSY

Increased Lucid Dreaming Frequency in Narcolepsy

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Study Objective: Nightmares are a frequent symptom in narcolepsy. Lucid dreaming, i.e., the phenomenon of becoming aware of the dreaming state during dreaming, has been demonstrated to be of therapeutic value for recurrent nightmares. Data on lucid dreaming in narcolepsy patients, however, is sparse. The aim of this study was to evaluate the frequency of recalled dreams (DF), nightmares (NF), and lucid dreams (LDF) in narcolepsy patients compared to healthy controls. In addition, we explored if dream lucidity provides relief during nightmares in narcolepsy patients.

Design: We interviewed patients with narcolepsy and healthy controls.

Setting: Telephone interview.

Patients: 60 patients diagnosed with narcolepsy (23–82 years, 35 females) and 919 control subjects (14–93 years, 497 females)

Interventions: N/A.

Measurements and Results: Logistic regression revealed significant ($P < 0.001$) differences in DF, NF, and LDF between narcolepsy patients and controls after controlling for age and gender, with effect sizes lying in the large range (Cohen's $d > 0.8$). The differences in NF and LDF between patients and controls stayed significant after controlling for DF. Comparison of 35 narcolepsy patients currently under medication with their former drug-free period revealed significant differences in DF and NF ($z < 0.05$, signed-rank test) but not LDF ($z = 0.8$). Irrespective of medication, 70% of narcolepsy patients with experience in lucid dreaming indicated that dream lucidity provides relief during nightmares.

Conclusion: Narcolepsy patients experience a markedly higher lucid dreaming frequency compared to controls, and many patients report a positive impact of dream lucidity on the distress experienced from nightmares.

Keywords: narcolepsy, dreaming, nightmares, lucid dreaming

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INTRODUCTION

Narcolepsy is a disabling and chronic sleep-wake disorder primarily characterized by excessive daytime sleepiness, irresistible sleep attacks, and cataplexy.^{1,2} As other sleep disorders,³ narcolepsy is associated with changes in dream mentation: Narcolepsy patients have a higher dream recall frequency than both healthy controls and patients with other sleep disorders.^{4,5} In addition, narcolepsy patients describe their dreams as very vivid and often disturbing,^{6–8} and content analytic studies indicate that dreams of narcolepsy patients are more negative, longer, and more bizarre than dreams of healthy controls.^{4,9,10} Nightmare disorder is frequently present in narcolepsy patients¹¹; even compared to patients with other sleep disorders, nightmare frequency is increased in narcolepsy.⁵

Lucid dreaming, defined as dreaming during which the dreamer is aware that he or she is dreaming, has been demonstrated to be an effective therapy for recurrent nightmares.^{12–14} Although dream phenomenology in narcolepsy is well documented, the occurrence of lucid dreaming in narcolepsy and its possible benefit for nightmare relief has been poorly investigated. The aim of the present study was to investigate lucid dreaming in patients with narcolepsy. Since anecdotal reports and studies with very small sample sizes suggest that narcolepsy patients frequently reported that they are aware

of their dreaming state while dreaming,^{15–17} we expected a higher number of lucid dreams in this patient group compared to a representative control sample of the general population. As narcolepsy can be conceptualized as a disorder of state boundary control both physiologically and psychologically,^{18,19} we further hypothesized that higher lucid dreaming frequency cannot be explained by higher overall dream recall frequency. Phenomenological features of lucid dreaming were studied in this patient group, including the question if narcolepsy patients feel relief through dream lucidity during nightmares.

METHODS

Participants

Eighty-three patients who met diagnostic criteria for narcolepsy (with and without cataplexy) were contacted after giving informed consent to be called for research purposes. Patients were diagnosed via sleep history, polysomnographic recordings of 2 nights, and multiple sleep latency test (MSLT). Physicians of the patients were contacted to confirm the diagnosis of narcolepsy for cases not diagnosed and treated in the Max Planck Institute of Psychiatry, Munich. The diagnosis of narcolepsy according to the International Classification of Sleep Disorders, 1st edition (ICSD-1) criteria was verified in all 83 patients. Of the 83 patients initially contacted, 60 patients participated in the present study (mean age 53.8 years [SD 7.8], age range 23–82 years; 35 women). Reasons for dropouts were as follows: outdated contact information ($n = 15$), declined to participate ($n = 3$), not available for interview ($n = 2$), seriously ill ($n = 2$), and patient died ($n = 1$). Mean duration since diagnosis was 14.3 years, SD 7.8, range 4–26 years. Fifty-one patients (85%) were diagnosed with narcolepsy with cataplexy; 40 of

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Table 1—Number of narcolepsy patients receiving medication.

	Medicated	If needed
Modafinil	19	3
Methylphenidate	9	4
Amphetamines	1	
Sodium oxybate	10	
Ephedrine	1	
Caffeine	1	
Antidepressants	27	
Benzodiazepines	1	
Neuroleptics	1	
Opiates	2	

these 51 were HLA positive, one patient was HLA negative, and HLA status was unknown for 10 patients. Fifty patients (83.3%) took medications during the study period; 35 of these could answer questions both for drug-free periods and for the period with the current medication. Of 50 medicated patients, 10 could indicate only about their medicated status and 5 took medication only if needed and were drug-free most of the time. Ten patients reported they were currently completely drug-free, with 5 of them being drug-naïve until now and 5 having taken medication previously but were unable to give further details for this period. Medications of narcolepsy patients are documented in Table 1. A sample of 919 subjects (mean age 48.1, SD 18.4, range 14–93 years; 497 females) representative of the general population served as control group. Further information about this sample is documented elsewhere.²⁰

Procedures

Both control subjects and patients were assessed with previously validated dream recall frequency scales via telephone interviews (methodological details are documented elsewhere^{20–22}). Specifically, to assess dream recall frequency (DF), participants were asked how often they remembered their dreams in the last few months on a 7-point rating scale ranging from 0 (never) to 6 (almost every morning). To obtain units of dreams per week, the scale was recoded using the class mean as follows: 0: never (class mean 0); 1: less than once a month (between 0 and 1 dream in 4 weeks, class mean 0.125); 2: about once a month (1 dream in 4 weeks, class mean 0.25); 3: two or three times a month (2–3 dreams in 4 weeks, class mean 0.625); 4: about once a week (class mean 1.0), 5: several times a week (2–5 dreams per week, class mean = 3.5); 6: almost every morning (6–7 dreams per week, class mean = 6.5).

Nightmare frequency (NF) and lucid dream frequency (LDF) were assessed using an 8-point rating scale. Definitions of nightmares and lucid dreams were provided (*Nightmares are dreams with such strong negative feelings that one wakes up. The storyline of the nightmare can be remembered very well. / During lucid dreaming, one is, while dreaming, aware of the fact that one is dreaming. It is possible to wake up deliberately, to control the dream action or to observe passively the course of the dream with this awareness.*), and before the patient answered, it was double-checked that patients did not confuse lucid dreams with hypnagogic or hypnopompic hallucinations.

The answer categories were as follows: 0: never, 1: less than once a year, 2: about once a year, 3: about 2 to 4 times a year, 4: about once a month, 5: two or three times a month, 6: about once a week, 7: several times a week. In order to obtain units in dreams per month, the scales were recoded using the class means (see above, 0 → 0, 1 → 0.042, 2 → 0.083, 3 → 0.25, 4 → 1.0, 5 → 2.5, 6 → 4.0, 7 → 18.0), i.e., if category 3 (about 2 to 4 times a year) was chosen, the value of 0.25 nightmares/lucid dreams per month was assigned.

For narcolepsy patients, additional questions were added after this first part of the interview. First, we asked if the occurrence of dream lucidity provided relief during nightmares. A 5-point rating scale was used: 1: I don't know, 2: almost never, 3: rarely, 4: yes, often, 5: yes, almost always. Furthermore, patients were asked when lucid dreams occurred most frequently across the 24-hour cycle. The following categories were provided for the night: 1: never, 2: primarily at sleep onset, 3: primarily in the middle of night, 4: primarily at the end of night; and for the day: 1: never, 2: primarily in the morning, 3: primarily during the day, 4: primarily in the evening.

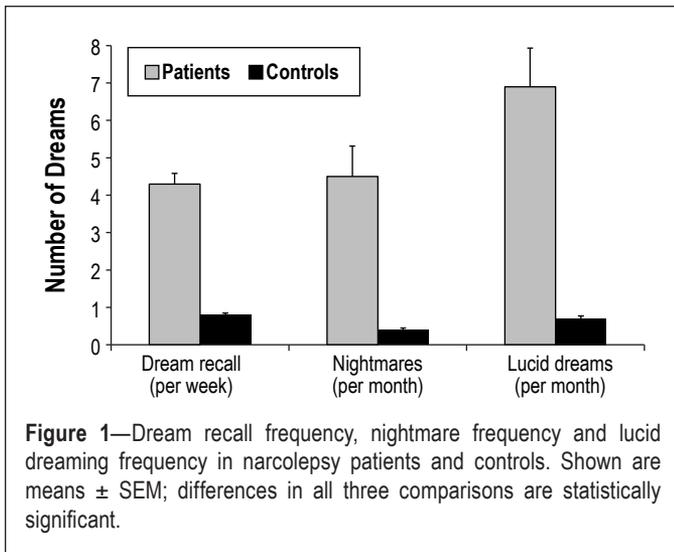
Statistical Analysis

We compared dream frequency data of the 60 narcolepsy patients with the 919 subjects of the control group via ordinal regression, including gender and age as regressors. Furthermore, via Wilcoxon rank-sum test we compared dream recall, nightmare relief, and diurnal dream lucidity distribution of 10 currently drug-free narcolepsy patients with 45 medicated narcolepsy patients regarding dream frequencies, diurnal distribution of lucid dreaming, and potential relief experienced from dream lucidity during nightmares. We compared these variables also for the current status of 35 medicated narcolepsy patients with their former drug-free periods. Finally, we compared these variables in 10 patients receiving sodium oxybate with their former drug-free period. For all tests, we considered an α of $P = 0.05$ or $z = 0.05$, respectively, as statistically significant. All values are given as means \pm SEM unless indicated otherwise.

RESULTS

Dream Recall

Compared to controls, narcolepsy patients had a significantly higher DF (4.3 ± 0.3 vs. 0.8 ± 0.1 dreams per week, $d = 2.1$), NF (4.5 ± 0.8 vs. 0.4 ± 0.1 nightmares per month, $d = 0.9$), and LDF (6.9 ± 1.0 vs. 0.7 ± 0.1 lucid dreams per month, $d = 1.1$), with very large effect sizes illustrating strong differences between the groups (Figure 1). While more than 3 of 4 patients experienced lucid dreams at least from time to time, only every second control subject knew the phenomenon from his or her own experience. Furthermore, DF, NF, and LDF turned out to be higher in women and to decrease with age. After controlling for the effects of gender and age via logistic regression, differences in DF, NF, and LDF between the groups were still highly significant. Also when DF was introduced into the regression analysis, differences in NF and LDF between narcolepsy patients and controls remained statistically significant. Hence, increased frequency of nightmares and lucid dreams in narcolepsy patients cannot be fully explained by increased overall dream recall frequency. For statistical details, see Table 2.



Clinical Value and Diurnal Distribution of Lucid Dreaming

Of the 47 patients who experienced lucid dreams at least from time to time, 33 patients felt relieved through dream lucidity during nightmares at least sometimes, with 20 patients profiting from dream lucidity often or almost always. Regarding the diurnal distribution of dream lucidity, 10 patients had lucid dreams primarily at sleep onset, 9 primarily in the middle of the night, and 27 primarily at the end of the night. Furthermore, 2 of 3 patients with lucid dreaming experience also had lucid dreams during daytime. For details, see Table 3.

Medication Effects

DF, NF, and LDF did not differ between 10 drug-naïve and 45 medicated patients ($P > 0.4$ each; 5 narcolepsy patients who took medication infrequently were excluded from this analysis). The diurnal distribution of dream lucidity differed neither during the night nor during the day between subgroups ($P > 0.5$ each). We also found no significant difference between these groups concerning the question whether dream lucidity provided relief during nightmares ($P = 0.68$). We further compared the status of 35 medicated patients with their former drug-free periods and found significant lower DF ($P = 0.018$) and NF ($P < 0.001$) during the medicated status, but no difference for LDF ($P = 0.81$). We also did not find any difference in the diurnal distribution of the occurrence of dream lucidity or experience of relief through dream lucidity during nightmares between medication states ($z > 0.24$ each; Table 3). Finally, we compared the status of 10 patients receiving sodium oxybate with their former drug-free periods and found a significant lower DF ($P = 0.023$) and NF ($P = 0.037$) under sodium oxybate, but again no difference for LDF ($P = 0.14$).

DISCUSSION

We found a strongly increased lucid dreaming frequency in 60 narcolepsy patients as compared to a representative sample of 919 control subjects. This increase stayed significant after statistically controlling for age, gender, and generally increased dream recall frequency in narcolepsy patients. Physiologically, narcolepsy has been conceptualized as disorder of state boundary control,¹⁸ and anatomical changes in

Table 2—Logistic regressions comparing narcolepsy patients with controls.

Variable	Standardized Estimate	χ^2	P
Dream frequency			
Diagnosis	0.46	155.2	0.001
Age	-0.13	16.0	0.001
Sex	0.15	26.6	0.001
Nightmare frequency			
Diagnosis	0.40	132.9	0.001
Age	-0.15	21.6	0.001
Sex	0.08	6.2	0.013
Nightmare/dream frequency			
Diagnosis	0.21	32.1	0.001
Age	-0.10	8.2	0.003
Sex	0.01	0.1	0.778
DF	0.61	225.0	0.001
Lucid dream frequency			
Diagnosis	0.32	99.6	0.001
Age	-0.09	8.1	0.004
Sex	0.11	10.2	0.002
Lucid dream/dream frequency			
Diagnosis	0.11	9.1	0.003
Age	-0.01	0.0	0.866
Sex	0.03	0.8	0.364
DF	0.75	307.2	0.001

Significant effects are indicated by bold print.

the hypothalamus as the key switch of the wake-sleep cycle have repeatedly been documented in narcolepsy.^{23,24} Also psychologically, narcolepsy patients sometimes fail to establish the boundaries between real experience and dream mentation during sleep paralysis,²⁵ or mistake the memory of a dream for a real experience.¹⁹ Our data show that also during dreaming, narcolepsy patients cognitively transgress normal state boundaries and frequently acquire wake-like insight into their current state. An effective strategy to induce lucid dreams in healthy subjects is the so called wake-up-back-to-bed technique, by which subjects are awakened in the early morning hours and go back to sleep after a period of wakefulness.^{26,27} In narcolepsy patients, symptoms of fragmented night sleep, a short sleep latency, and sleep onset REM periods might exert effects similar to intentional wake-up-back-to-bed schedules. On first sight a parallel decrease of dream frequency and increase of nocturnal awakening as seen in normal ageing appears inconsistent with this view; however, ageing is also associated with decline in memory functions, reduced circadian modulation of REM sleep, and decrease in REM sleep time,^{28,29} which might counteract potential effects of age-related sleep fragmentation on lucid dream frequency.

The finding of higher dream recall frequency in narcolepsy patients is in line with previous studies.^{4,5} It might be explained by the arousal-retrieval-model,³⁰ postulating that dreams can only be retrieved if awakening occurs while a short-term memory trace of the dream is still active. Dream recall frequency is indeed correlated with the number of nocturnal

Table 3—Dream frequency, diurnal distribution of the occurrence of dream lucidity, and experience of relief during nightmares through dream lucidity in all 60 patients with narcolepsy; in 10 drug-naïve and 45 medicated patients; and in 35 medicated patients compared to their former drug-free periods.

	All (n = 60)	Drug-Naïve (n = 10)	Medicated (n = 45)	Drug-Free Phase (n = 35)	Medicated Phase (n = 35)
Dream Frequency					
Dreams per week	4.3 ± 0.3	4.2 ± 0.7	4.3 ± 0.3	5.3 ± 0.3	4.2 ± 0.4
Nightmares per month	4.5 ± 0.8	5.1 ± 2.2	3.6 ± 0.8	10.9 ± 1.4	3.7 ± 0.9
Lucid dreams per month	6.9 ± 1.0	7.8 ± 2.8	6.2 ± 1.1	9.1 ± 1.5	7.1 ± 1.4
Dream Lucidity during Nighttime					
Never	14	3	11	10	8
Primarily at sleep onset	10	0	8	5	7
Primarily in the middle of the night	9	2	4	6	3
Primarily at the end of the night	27	5	22	14	17
Dream Lucidity during Daytime					
Never	29	6	22	16	16
Primarily in the morning	2	0	2	0	1
Primarily during the day	28	4	20	19	17
Primarily in the evening	1	0	1	0	1
Nightmare Relief through Lucidity					
Almost always	10	3	6	12	10
Often	10	1	8	3	5
Rarely	13	2	10	7	9
Almost never	8	0	6	7	5
I don't know	19	4	15	6	6

Dream frequencies are given as means ± SEM, diurnal dream lucidity distribution and relief data are given as number of patients. Significant differences between subgroups are indicated by bold print.

awakenings.³¹ As in insomnia, in narcolepsy high levels of arousal during both night and day might favor the retention of dream memories, which are forgotten more frequently in healthy subjects.³² Also, our findings of a negative association between age and dream recall frequency and of a higher dream recall frequency in females compared to males are in line with previous studies.^{33–36}

The finding of an increased nightmare frequency (also controlled for general dream recall) in narcolepsy patients confirms many previous studies. Generally, narcolepsy patients experience longer, more complex, more negative, and more vivid dream mentation than healthy subjects,^{4,6,8,9,37,38} and nightmares are a frequent symptom in narcolepsy.^{5,11} According to a current model of nightmare etiology,³⁹ two factors might explain increased nightmare frequency in narcolepsy patients. First, daytime stress due to the impairments caused by narcolepsy might be reflected in patients' dreams, as current stressors exert strong effects on nightmare frequency also in healthy controls.⁴⁰ Second, brain activation in limbic areas and particularly the amygdala might be higher in narcolepsy patients due to their hyperactive REM sleep system. However, to our knowledge there is no fMRI/EEG study of REM sleep in narcolepsy patients that has tested this hypothesis.

We further found that 70% of the narcolepsy patients in our study who had experience with lucid dreaming indicated that dream lucidity provides relief during nightmares, independent of medication status. Dream lucidity enables dreamers to influence dream content, thereby potentially also altering negative dream mentation.^{41,42} Lucid dreaming has indeed

repeatedly been shown to be an effective therapy for nightmare disorder.^{13,14,43} Anatomical changes of the amygdala,⁴⁴ altered amygdala activity related to fear conditioning during wakefulness,⁴⁵ and hypermetabolism in further emotion-related brain regions like the anterior cingulate during sleep have been observed in narcolepsy, which might be related to nightmare symptomology.⁴⁶ Neurocognitive models of disturbed dreaming emphasize a hyperresponsivity of the amygdala in nightmare generation, coupled with a failure of medial prefrontal regions to dampen this activation.³⁹ Lateral prefrontal regions have been shown capable to influence amygdala function through connections to the medial prefrontal cortex.⁴⁷ The dorsolateral prefrontal cortex activation has been demonstrated to subserve lucid dreaming^{48,49} and has been associated with therapeutic effects of lucidity training on recurrent nightmares.⁴⁹ Increased lucid dreaming frequency in narcolepsy patients might be considered as an underrecognized opportunity for a systematic therapy of narcolepsy-related nightmare symptoms: patients could be instructed to use dream lucidity to confront fearful dream elements in nightmares and, in turn, change the course of the dream plot. Since lucid dreaming is a skill that can be induced, e.g., by training⁵⁰ or electrical brain stimulation,⁵¹ patients without lucid dreaming experience might also profit from such a therapeutic strategy.

Medication status did not affect lucid dreaming frequency or relief experienced through dream lucidity during nightmares. However, patients indicated a significant lower dream recall and nightmare frequency under medication compared to previous drug-free periods. Many medications used in the

treatment of narcolepsy suppress REM sleep, which might explain decreased dream recall and nightmare frequency.⁵² Successful treatment reduces distress associated with the disease, which might further reduce nightmare frequency. Furthermore, narcolepsy medications like sodium oxybate improve sleep quality^{53,54} and support a regular sleep-wake rhythm.^{52,55} As dream recall frequency is correlated with the number of nocturnal awakenings, improved sleep quality might be further factor explaining the reduction of dream recall frequency under medication.³¹

Methodologically, two limitations of the medication data should be mentioned. First, even though coarse medication status for all patients was assessed, it was not possible to obtain specific details about exact medication dosages or times. Second, comparisons between medicated and medication-free periods rely on subjective estimates from memory, as patients were interviewed just once. Future studies on this topic should assess whether lucid dreaming is present before the initial classic manifestations of narcolepsy or whether it emerges concurrently with the classic symptoms or subsequently. It should also be objectively assessed whether lucid dreaming frequency is altered before the start of medication with potentially dream-altering drugs (e.g., antidepressants). Furthermore, more comprehensive information about the narcolepsy-related clinical context should be assessed in order to trace changes in lucid dreaming to their potential causal underpinnings. Finally, a more direct comparison with other sleep disorder patient groups might clarify if changes in lucid dreaming are associated with altered sleep regulation in general or with the specific neurophysiological changes of narcolepsy in particular.

In conclusion, narcolepsy patients reported a markedly increased lucid dreaming frequency compared to a large representative population sample. In line with therapeutic approaches using lucid dreaming training for treatment of nightmare disorder, a majority of patients who had experience with lucid dreaming felt that dream lucidity provides relief during nightmares. Hence, a more systematic use of lucid dreaming has to be considered as a promising approach for treating nightmare symptoms in narcolepsy.

DISCLOSURE STATEMENT

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