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Sleep pathophysiology and cognitive-behavioral treatment of posttraumatic and idiopathic nightmares

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SUMMARY

Complaints of disrupted sleep and nightmares are known to be highly prevalent in patients suffering from posttraumatic stress disorder (PTSD). However, no study has investigated the relationship between these two sleep phenomena in PTSD patients. It is possible that sleep disturbances in PTSD patients may arise from an underlying mechanism related to nightmares. If so, people who suffer from non-PTSD idiopathic nightmares (I-NM) should exhibit sleep disturbances comparable to those observed in PTSD patients who report frequent nightmares (P-NM). This also implies that nightmare alleviation should be accompanied by quantifiable improvements in sleep. The efficacy of imagery rehearsal (a cognitive-behavioural technique) for alleviating nightmare frequency and associated symptoms of psychological distress has been demonstrated but never independently replicated. Moreover, polysomnographic (PSG) methods have never been used to assess sleep quality both pre- and post-treatment in P-NM and I-NM patients.

The goal of the first study was thus to investigate whether I-NM and P-NM patients exhibit more sleep anomalies than healthy control (CTL) participants, and whether sleep anomalies observed in the former two groups are similar. The goals of the second study were 1) to independently replicate the efficacy of imagery rehearsal for alleviating nightmares, and 2) to investigate whether nightmare alleviation is associated with quantifiable improvements in sleep.

In the first study, we demonstrated that both P-NM and I-NM patients exhibit more periodic leg movements in sleep (PLMS) than do healthy participants, but do not differ from each other on this measure. Further, P-NM

patients demonstrate more nocturnal awakenings than do either I-NM patients or CTL participants. The results suggest that increased motor activity in sleep may be a correlate of intense negative dreaming in nightmare patients, whereas the increased number of nocturnal awakenings may be related to the hyperarousal component of PTSD.

In the second study, the efficacy of imagery rehearsal for alleviating nightmares and waking symptoms of psychological distress was replicated. I-NM and P-NM patients demonstrated different patterns of response to treatment however. I-NM patients reported significantly fewer nightmares and bad dreams and a slight reduction in psychological distress. P-NM patients exhibited significant reduction in symptoms of psychological distress, but only slightly fewer bad dreams. Pre/post-treatment comparisons of sleep measures revealed that I-NM had significantly fewer PLMS in REM sleep post-treatment, whereas P-NM patients had increases in both the micro-arousal index and the REM density measure. These results suggest that a reduction in REM sleep motor activity parallels the reduction in frequency of disturbing dreams in I-NM patients only, and that these patients benefit primarily from the alleviation of nightmares. P-NM patients appear to benefit primarily from the alleviation of symptoms of waking psychological distress. In P-NM patients, treatment may also facilitate emotional processing during sleep, as suggested by the increased REM density and micro-arousal measures.

RÉSUMÉ

Sujet: Près de 90% des personnes souffrant d'un syndrome de stress post-traumatique (SSPT) rapportent des difficultés de sommeil, telles des difficultés à s'endormir, de nombreux réveils pendant la nuit et des cauchemars fréquents. Plusieurs études menées en laboratoire de sommeil avec des gens souffrant d'un SSPT ont tenté de clarifier la nature de ces difficultés de sommeil. Toutefois, les résultats de ces études divergent. Aucune de ces études n'a toutefois exploré la possibilité que les cauchemars puissent être un facteur principal contribuant aux anomalies du sommeil chez les patients souffrant d'un SSPT. Les cauchemars sont définis comme des rêves extrêmement dérangeants desquels le dormeur se réveille. Donc, de par leur composante affective marquante et leur composante comportementale (c.-à-d., le réveil), il est possible que les cauchemars jouent un rôle important dans l'apparition et le maintien des anomalies du sommeil chez les patients souffrant d'un SSPT et de cauchemars fréquents (SSPT+C).

Afin de vérifier si les cauchemars fréquents peuvent en effet contribuer aux anomalies du sommeil observées chez les patients SSPT+C, leur profil de sommeil sont comparés à ceux de patients souffrant de cauchemars idiopathiques (donc non-reliés au SSPT) et à ceux de sujets sains dans la première étude présentée dans cette thèse. L'hypothèse est que les patients SSPT+C et les patients souffrant de cauchemars idiopathiques (C-I) démontreront plus d'anomalies du sommeil que les participants sains et que les deux groupes de patients démontreront des profils de sommeil semblables.

Par ailleurs, la possibilité que les cauchemars jouent un rôle important dans les anomalies du sommeil suggère implicitement qu'une diminution des cauchemars devrait être accompagnée par une réduction marquée des anomalies du sommeil chez ces patients. La seconde étude vise donc à investiguer cette proposition. Une série d'études a démontré l'efficacité de la technique cognitivo-comportementale de répétition d'imagerie mentale (*imagery rehearsal*) pour réduire la fréquence des cauchemars chez les patients SSPT+C ainsi que chez les patients C-I. La diminution de la fréquence des cauchemars chez ces deux groupes de patients semble aussi être reliée à l'amélioration de la qualité du sommeil et à une réduction des symptômes de détresse psychologique, telles que mesurées par questionnaires auto-évaluatifs et rétrospectifs. Toutefois, aucune étude externe n'a reproduit l'efficacité de ce traitement et l'amélioration de la qualité du sommeil n'a jamais été corroborée par mesures polysomnographiques (c.-à-d., en laboratoire de sommeil). De plus, des mesures prospectives évaluant la diminution des cauchemars suite au traitement n'ont jamais été utilisées. La seconde étude comporte donc deux hypothèses : 1) Suite au traitement cognitivo-comportemental, les patients souffrant de cauchemars démontreront une réduction significative de la fréquence des cauchemars ainsi qu'une diminution des symptômes de détresse psychologique, et 2) Suite au traitement cognitivo-comportemental, les patients souffrant de cauchemars démontreront une meilleure qualité de sommeil telle que mesurée par des enregistrements polysomnographiques. Une meilleure qualité de sommeil est opérationnellement définie comme étant une augmentation de l'efficacité du sommeil et la diminution de la fragmentation du sommeil.

Méthodologie. Onze patients C-I et neuf patients SSPT+C ont participé à la première étude. Tous rapportaient plus d'un cauchemar par semaine, depuis plus de six mois. Aucun ne rapportait être sous médication, souffrir d'un autre trouble de sommeil, de troubles psychiatriques ou neurologiques majeurs ou abuser d'alcool ou de drogues. Treize sujets sains pairés aux patients souffrant de cauchemars pour l'âge et le sexe et remplissant les mêmes critères d'inclusion formaient le groupe contrôle (CTL). Avant de dormir en laboratoire de sommeil pendant deux nuits consécutives où des évaluations polysomnographiques de leur sommeil étaient menées, chaque participant devait remplir une série de questionnaires mesurant les symptômes d'anxiété, de détresse reliée aux cauchemars et à la dépression. Tous les participants devaient aussi remplir un journal de rêves pendant 15 matins consécutifs.

Dans la deuxième étude, six patients SSPT+C et six patients C-I ont reçu le traitement cognitivo-comportemental de répétition d'imagerie mentale. Le traitement était offert en groupes de deux à cinq personnes et en une seule session de trois heures. Lors de cette session, des informations générales concernant les cauchemars et le sommeil étaient d'abord données aux participants, puis la technique de répétition d'imagerie mentale était présentée et pratiquée une fois. Les participants devaient, par la suite, pratiquer cette technique à la maison, au moins une fois par jour, à chaque jour pendant les quatre à six prochaines semaines. Comme dans la première étude, les participants ont complété à nouveau un journal de rêves pendant 15 matins consécutifs précédents leur seconde venue en laboratoire de sommeil. Les

questionnaires de détresse psychologique ont également été complétés à nouveau. L'évaluation polysomnographique post-traitement était menée en moyenne 8.5 semaines post-traitement.

Résultats. Dans la première étude, les indices de mouvements périodiques de jambes (MPJ) en SP et non-SP associés ou non à des micro-éveils, se sont révélés plus élevés chez les deux groupes de patients souffrant de cauchemars comparés au groupe de sujets sains. Cependant, les patients SSPT+C et C-I ne différaient pas les uns des autres. Toutefois, les patients SSPT+C ont aussi démontré un nombre plus élevé de réveils nocturnes que les patients I-C et les sujets sains.

Dans la deuxième étude, nous avons d'abord reproduit de façon indépendante l'efficacité de la répétition d'imagerie mentale pour diminuer les cauchemars à l'aide de la mesure rétrospective de fréquence des cauchemars. De plus, une diminution des symptômes d'anxiété et de détresse reliée aux cauchemars a aussi été observée. Des changements majeurs du sommeil, à l'évaluation PSG post-traitement, n'ont toutefois pas été observés. Seules une augmentation de l'index de micro-éveils et une légère diminution du pourcentage de sommeil de stade 4 ont été révélées post-traitement. De plus, les patients SSPT+C et I-C ont démontré des patrons divergents de réponses au traitement. Plus précisément, seuls les patients I-C rapportaient significativement moins de cauchemars sur la mesure rétrospective et de mauvais rêves sur la mesure prospective. Ce groupe de patients démontrait aussi de légères réductions des symptômes de dépression et d'anxiété. Pour les patients SSPT+C, le principal

effet du traitement était associé à une réduction marquée des symptômes d'anxiété, de détresse reliée aux cauchemars et du SSPT. Seule une diminution modérée de la fréquence des mauvais rêves a été observée post-traitement pour ce groupe de patients.

Aux évaluations PSG post-traitement, les patients I-C ont présenté une augmentation du pourcentage de sommeil de stade 2, ainsi qu'une diminution de l'index de MPJ en SP. Les patients SSPT+C, eux, ont démontré une augmentation de l'index de micro-éveil et une légère augmentation de la densité des MOR post-traitement.

Conclusion. Les résultats de la première étude indiquent tout d'abord que les patients souffrant de cauchemars chroniques et fréquents présentent peu de différences quantifiables au niveau de leurs profils de sommeil comparativement à ceux de sujets sains. Toutefois, l'augmentation des MPJ observée chez les patients SSPT+C et I-C suggère que cette activité motrice en sommeil pourrait être un corrélat de processus oniriques anormalement intenses. Les nombreux réveils nocturnes observés chez les patients SSPT+C semble être en lien avec un processus relié à l'hyper-réactivité propre au SSPT. Il apparaît donc que, chez les patients souffrant de cauchemars, la nature affective des cauchemars soit associée à certaines manifestations comportementales en sommeil, telle que suggérée par l'augmentation des MPJ.

La deuxième étude supporte cette dernière possibilité chez les patients C-I qui ont démontré une diminution marquée des mauvais rêves associée à une diminution des MPJ en SP post-traitement. Chez les patients SSPT+C, l'effet primaire du traitement semble être de diminuer les symptômes de détresse psychologique à l'éveil. Ainsi, il est possible que la répétition d'imagerie mentale facilite le traitement de matériel émotionnel pendant le sommeil chez ces patients, tel que suggéré par l'augmentation des MOR et des micro-éveils.

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LIST OF ENGLISH ABBREVIATIONS

CTL: Control participants

I-NM: Idiopathic nightmares

PLMS: Periodic leg movements in sleep

P-NM: Posttraumatic nightmares

PSG: Polysomnography

REM: Rapid eye movement

REML: REM sleep latency

SE: Sleep efficiency

SOL: Sleep onset latency

TST: Total sleep time

WASO: Wake-up after sleep onset

%S1: Percent of the total recording time spent in Stage 1 sleep

%S2: Percent of the total recording time spent in Stage 2 sleep

%S3: Percent of the total recording time spent in Stage 3 sleep

%S4: Percent of the total recording time spent in Stage 4 sleep

%REM: Percent of the total recording time spent in REM sleep

LISTE DES ABBRÉVIATIONS EN FRANÇAIS

C-I: Cauchemars idiopathiques

MPJ: Mouvements périodiques des jambes

MOR:Mouvements oculaires rapides

PSG: Polysomnographie

SSPT: Syndrome de stress posttraumatique

SSPT+C: Syndrome de stress posttraumatique et cauchemars fréquents

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À P'pa & M'man,

Mes exemples de réussite.

Et à moi-même, just because.

"Être couché la lumière ouverte,
c'est équivalent à être assis la lumière fermée".
En fait, non.

I. GENERAL INTRODUCTION

1. NIGHTMARES AND SLEEP DISTURBANCES AS CORE SYMPTOMS OF PTSD

1.1 Historical precursors to posttraumatic stress disorder

The notion that combat exposure is accompanied by a wide array of extreme psychological, behavioural, and physiological reactions has long been recognized. Homer, in the *Odyssey*, describes how some Greek soldiers fighting in the Trojan War have visions of the horror they witnessed and how some isolated themselves from their companions for fear of hurting them involuntarily. Posttraumatic reactions associated with combat exposure were repeatedly observed in subsequent centuries, and have been referred to as posttraumatic neurosis or soldier's heart (Erichsen, 1886, cited in van der Kolk, Weisaeth, & van de Hart, 1996; Oppenheim, 1889, cited in Sparr, 1995), shell shock after World War I (Myers, 1940, Kardiner, 1941), combat or war neurosis after World War II, (Grinker & Spielgel, 1945; Greenberg, Pearlman, & Gambel, 1972a), and combat fatigue after the Korean War (Leopold, & Dillon, 1963; Archibald, & Tuddenham, 1965).

The most commonly reported and salient features of combat exposure were exaggerated fright reactions, terrifying trauma-related nightmares and sleep disturbances, numbness, irritability, mood disturbances, exhaustion, and psychosomatic symptoms (Archibald, & Tuddenham, 1965; DeFazio, 1975; Erichsen, 1886, cited in van der Kolk et al., 1996; Grinker & Spielgel, 1945; Kardiner, 1941; Myers, 1940).

Post World War II, these posttraumatic reactions were also reported following all types of traumas such rape (Burgess & Holstrum, 1974; Kilpatrick, Veronen, & Resnick, 1979), natural disasters (Stierlin, 1909/1911, cited in van der Kolk et al., 1996; Parad, Resnick, & Parad, 1976), and the Holocaust (Etinger, 1961; Oswald & Bittner, 1964). It thus became clear that the trauma itself did not influence the specific nature of symptoms, but rather, that various traumas elicited the same arrays of psychological, behavioural, and physiological responses.

In 1980, the American Psychiatric Association (APA) first proposed the diagnostic category of posttraumatic stress disorder (PTSD) in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III). The subsequent editions have refined the definition of trauma, added a few avoidance symptoms, and deleted certain items (Kilpatrick et al., 1994). No changes, however, have been made to the diagnostic criteria concerning dreams and sleep disturbances. PTSD in adults is currently defined by three core anxiety symptom clusters: intrusion symptoms (e.g., flashbacks, nightmares), avoidance symptoms (e.g. efforts to avoid thoughts or activities related to the trauma), and hyperarousal symptoms (e.g., hypervigilance, sleep disturbances). These symptoms persist for over one month after a person has been exposed to an event threatening the integrity of the self and involving intense fear and helplessness (Appendix A).

Today, nightmares are part of the intrusion symptom cluster, and 75% to 90% of PTSD patients report them (Horowitz, Wilner, Kaltreider, & Alvarez, 1980; Kilpatrick et al., 1994; Riggs, Rothbaum, & Foa, 1995; Rothbaum, Foa, Riggs,

Murdock, & Walsh, 1992; van der Kolk et al., 1980). Sleep disturbances, such as insomnia complaints and restless sleep, are included in the arousal symptom cluster. As many as 90% of PTSD patients complain of sleep disturbances (Brown & Boudewyns, 1996; Krakow et al., 2000a; Ohayon & Shapiro, 2000; Riggs et al., 1995; Rothbaum et al., 1992). Both nightmare and sleep disturbance items have been shown to have high sensitivity, specificity, and predictive power for current PTSD diagnosis (Kilpatrick et al., 1994; Riggs et al., 1995).

Since the introduction of the PTSD diagnostic category, several instruments have been used for assessing PTSD presence and severity. The most commonly used is the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979). The IES assesses the frequency of the intrusion and avoidance symptoms. This instrument is a 15-item self-report inventory that has been validated in several traumatized populations (Allen, 1994). The PTSD Symptom Scale (PSS) is another self-report instrument frequently used with sexual assault and non-sexual crime victims (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993). It consists in a 17-item questionnaire assessing the intensity of PTSD symptoms (according to the DSM-III-R criteria) in the preceding 2 weeks (Appendix B). Among structured interviews, the Structured Clinician Interview (SCID; Spitzer, Williams, & Gibbon, 1987) and the Clinician-Administered PTSD Scales (CAPS; Blake et al., 1993) are the most commonly used. The SCID is mostly used for research purposes, whereas the CAPS is mostly used for diagnostic purposes. The latter consists of a 17-item structured interview and allows for determination of current or lifetime presence of PTSD, and symptom frequency and severity (Appendix C).

Cognitive-behavioural treatments for alleviating PTSD symptoms have also been developed since 1980. These have been shown effective and are the most commonly used modality for alleviating PTSD severity (Foa & Rothbaum, 1998; Shalev, Bonne & Eth, 1996; Solomon, Gerrity, & Mudd, 1992). Recent reviews on the pharmacological treatments of PTSD suggest that antidepressants, especially selective serotonin reuptake inhibitors (SSRIs), may also be promising for the treatment of PTSD symptoms (Pearlstein, 2000; Shalev et al., 1996). However, controlled clinical trials comparing the efficacy of cognitive-behavioural interventions and pharmacological treatments for alleviating PTSD symptoms have not yet been conducted.

To explain PTSD pathogenesis, several psychophysiological hypotheses have been proposed. These state that PTSD is first elicited by a conditioned fear response, which is triggered by a traumatic event and causes intense cognitive, behavioural, emotional and physiological reactions. PTSD is then maintained by operant conditioning (Foa, & Rothbaum, 1998; Shalev & Rogel-Fuchs, 1993; Yehuda, 2000). The persistence of PTSD is conceptualized as a failure of the organism to return to its pre-trauma state, both psychologically and physiologically (Casada, Amdur, Larsen, & Liberzon, 1998; Foa, & Rothbaum, 1998; Southwick, Bremner, Krystal, & Charney, 1994; Yehuda, 2000). According to these hypotheses, nightmares in PTSD are a form of conditioned fear stimulus, whereas sleep disturbances are correlates of the fear response, or hyperarousal.

However, hypotheses such as these are largely uninformed by the large literature on sleep disturbances and nightmares in PTSD. Hypotheses that have considered such findings are presented in section 1.3. To fully appreciate these,

the definitions of sleep disturbances and nightmares, as well as a description of the standard methodology for studying them in the laboratory will first be presented. A review of the pertinent sleep literature will then be provided in sections 2.1 and 2.2.

1.2 Operational definitions of sleep disorders, nightmares, and polysomnography.

1.2.1 Sleep disorders

Even though descriptions of sleep disorders such as narcolepsy and sleep apnea were present in the late nineteenth century (Dement, 2000), it is in the last 30 years that the multidisciplinary area of sleep medicine has been extensively developed. To this day, the publication rate in sleep medicine has expanded at a higher rate than that of the medical sciences in general (Nielsen & Germain, 1998).

The most common subjectively reported indicators of abnormal sleep are insomnia complaints (i.e., difficulty falling or staying asleep), reports of abnormal behaviours or sensations during the sleep episode (e.g., sleepwalking, gasping), and excessive daytime sleepiness (Aldrich, 2000). These complaints, however, are non-specific in that patients suffering from a wide variety of sleep disorders will report them.

At the present time, the *International Classification of Sleep Disorders* (ICSD, 1997) proposes three main categories of sleep disorders, which comprise

several subcategories (Thorpy, 2000). The first category is that of Dyssomnias and encompasses disorders associated with either insomnia complaints or excessive daytime sleepiness. The subcategories of Dyssomnias are 1) Intrinsic sleep disorders (e.g., obstructive sleep apnea), 2) Extrinsic sleep disorders (e.g., inadequate sleep hygiene), and 3) Circadian rhythm sleep disorders (e.g., delayed sleep phase syndrome). The second category of sleep disorders is that of Parasomnias, and includes four subcategories: 1) Arousal disorder (e.g. sleep terrors), 2) Sleep-wake transition disorders (e.g. sleeptalking), 3) Parasomnias usually associated with rapid-eye-movement (REM) sleep (e.g. nightmares; see section 1.2.2 below), and 4) Other parasomnias (e.g. sleep bruxism). Finally, the third category of sleep disorders proposed by the ICSD refers to sleep disorders associated with medical, neurological, or psychiatric conditions.

To determine the specific nature of the sleep disturbance underlying the reported sleep complaints, an investigation of the patient's medical, psychosocial, and familial history is required (Aldrich, 2000). A sleep evaluation conducted in the laboratory may also be necessary to determine the exact nature, presence and severity of the sleep disorder (Aldrich & Naylor, 2000; Standards of Practice Committee of the American Sleep Disorders Association, 1995). Further specifications regarding laboratory-assisted sleep evaluations are provided in section 1.2.3.

1.2.2 Nightmares

Operationally, nightmares are defined as repeated awakenings accompanied by detailed recall of extremely frightening dreams (APA, 1994).

They generally occur in the second half of the night, when REM sleep is most prominent (Fisher, Byrne, Edwards, & Kahn, 1970; Hartmann, 1984, Kales, et al., 1980; van der Kolk et al., 1984).

This definition emphasizes both an emotional (i.e., fear) and a behavioural (i.e., awakenings) component. The relevance of both components, however, has been questioned (Zadra & Donderi, 2000). Although it is true that fear is the most commonly reported emotion in nightmares (Brimacombe & Macfie, 1992; Dunn & Barrett, 1988; Feldman & Hersen, 1967), other emotions, such as anxiety, disgust, anger, and grief are also commonly reported (Dunn & Barrett, 1988; Zadra & Donderi, 1993). With regards to the awakening component, one study has shown that only 25% of frequent nightmare sufferers report always waking up after an intense and unpleasant dream (Krakow, Tandberg, Barey, & Scriggins, 1995b). This suggests that awakenings from unpleasant dreams are rather uncommon. Whether the disturbing dreams reported by PTSD patients are always associated with awakenings is uncertain. However, awakenings following distressing dreams are rarely observed when PTSD patients sleep in a laboratory environment (Dow, Kelsoe, & Gillin, 1996; Glaubman, Mikulincer, Porat, Wasserman, & Birger, 1990; Mellman, David, Kulick-Bell, Hebding, & Nolan, 1995a; Mellman, Kulick-Bell, Ashlock, & Nolan, 1995b, Mellman, Nolan, Hebding, Kulick-Bell, & Dominiguez, 1997; Ross et al., 1994; Woodward, Bliwise, & Friedman, 1996), even though they may report distressing oniric contents in the morning. One recent study conducted with students demonstrated that unpleasant dreams that do not awaken the sleeper (bad dreams) are more than 2.5 times as frequent as nightmares (unpleasant dreams that awaken the sleeper) yet their intensity is rated as being as intense as that of nightmares (Zadra & Donderi,

2000). This finding indicates that the intensity of an unpleasant dream is not a direct correlate of awakening from it. In the PTSD literature, the term disturbing dreams is generally used to refer to the extremely unpleasant dreams experienced by patients, irrespective of an awakening criterion.

In the PTSD literature, the distinction between nightmares and sleep terrors is seldom made. Nightmares and sleep terrors, however, differ in several respects. First, in contrast to nightmares, sleep terrors typically occur in the first half of the night during slow-wave sleep. The latter are considered a disorder of arousal (Broughton, 1968). Second, sleep terrors usually lack detailed descriptions of the mental content preceding sudden awakenings. Third, these sudden awakenings are accompanied by intense feelings of panic, and followed by a period of confusion (APA, 1994; Broughton, 2000). Confusion upon awakening from a nightmare is unusual. Despite the clear distinctions between nightmares and sleep terrors, some reports indicate that posttraumatic nightmares can occur early in the sleep cycle (e.g., Fisher et al., 1970, van der Kolk et al., 1984), when sleep terrors typically take place. This suggests that posttraumatic nightmares may be indicators of a more diffuse pathology than are idiopathic nightmares.

1.2.3 Polysomnography

In the late 60s, Rechtschaffen & Kales (1968) elaborated a standardized coding system for scoring sleep stages based on the electroencephalogram (EEG), the electromyogram (EMG), and the electrooculargram (EOG). Specific EEG electrode placements are determined using the International 10-20 electrode

placement system (Jasper, 1958; Appendix D). Based on these three objective measures, the authors proposed criteria for discriminating among five sleep stages (Appendix E). Each stage is defined according to specific criteria based on EEG patterns, EOG activity, and EMG levels (Rechtschaffen & Kales; 1968).

Although EEG, EOG, and EMG criteria are sufficient for sleep staging, additional measures complement sleep recordings and provide further specifications on sleep quality and on the presence or absence of sleep disorders. For instance, the regularity and efficiency of breathing during sleep can be quantified with nasal thermistance, and abdomen or chest belts or both, and oxymetry. Respiration monitoring is necessary to assess the presence of sleep-related breathing disorders such as obstructive sleep apnea (OSA) or upper airway resistance syndrome (UARS; Bassiri & Guilleminault, 2000). Given the close relationship between respiratory and cardiovascular functions, heart rate is also monitored during sleep evaluation, with two subclavicular leads. Leg movements in sleep are also typically recorded by leads placed on the anterior tibialis. These permit ruling out the presence of periodic leg movement disorder (PLMD; Montplaisir, Nicolas, Godbout, & Walters, 2000).

The ensemble of such measures, most frequently EEG, EOG, EMG, respiration, heart rate and leg activity, for recording sleep profiles is referred to as polysomnography (PSG). PSG recordings are considered the gold standard for investigating the presence and severity of sleep disorders (Standards of Practice Committee of the ASDA, 1995). Operational definitions of polysomnographic measures used to assess the nature and severity of sleep disorders are presented in Table 1 (Appendix F).

1.3 Sleep-related hypotheses of PTSD

The role of posttraumatic nightmares in the reactions to extreme stress has long been a matter of speculation. Freud (1920) suggested that posttraumatic nightmares were repetitive compulsions motivated by an attempt to retrospectively master the primary anxiety and guilt associated with a traumatic experience. Several subsequent theorists shared Freud's central notion in proposing that posttraumatic dreams are atypical dreams representing attempts to assimilate a traumatic experience into one's psyche during sleep (e.g., Hanlon, 1987; Kavaler, 1987; Kellerman, 1987; Mattoon, 1978; Mack, 1970).

Contemporary sleep-based hypotheses of PTSD nightmares are of two contrasting types. Although over the last 50 years cognitive and physiological perspectives have replaced psychoanalytical approaches to explaining dream function (Nielsen & Germain, 1998), the first type of contemporary sleep-based hypothesis of PTSD continues to consider posttraumatic nightmares as attempts to assimilate the trauma (Fiss, 1993; Greenberg, Katz, Schwartz, & Pearlman, 1992; Kramer; 1993; Newell & Cartwright, 2000). The premises of this current type of hypothesis are based on observations that REM sleep seems critical in learning acquisition (e.g., Smith & Lapp 1991; Smith, 1992; Guerrien, Dujardin, Mandai, Sockell, Leconte, 1989), memory consolidation (e.g., Benson & Feinberg, 1977; Grosvenor & Lack, 1984), emotional processing (e.g., Cartwright, 1983) and adaptation to stress (Greenberg, Pillard, & Pearlman, 1972b; Koulack, 1993). They state that REM sleep is critical to the PTSD recovery process. However,

there is no evidence supporting a causal relationship between REM sleep and PTSD recovery.

The second type of sleep-related PTSD hypothesis has been most influential in recent years. This type of hypothesis states that abnormal intensification of REM sleep may in fact be the core dysfunction of PTSD, rather than a sleep state enabling patients to process stressful experiences (Ross et al., 1989). This core REM sleep dysfunction hypothesis is based on the combined observations that nightmares are a core symptom of PTSD, that they usually occur in REM sleep (Fisher et al., 1970; Hartmann, 1984, van der Kolk et al., 1984), that REM sleep is a state of increased arousal, and that there is no evidence that posttraumatic nightmares facilitate PTSD recovery. Ross and his colleagues (1989) also suggested that the proposed core REM sleep dysfunction may participate in the production of other PTSD symptoms, such as flashbacks and hyperarousal symptoms. Nevertheless, there is no evidence of a causal relationship between intensification of REM sleep and PTSD pathogenesis.

A growing body of literature on sleep and PTSD indicates that both aforementioned hypotheses (i.e., adaptation and core REM sleep dysfunction) are only partially supported. Studies that have investigated the sleep characteristics of PTSD patients are reviewed in the following section to demonstrate the need for an alternative explanation about the relationship between sleep disturbances and PTSD.

2. The nature of Sleep disturbances in PTSD

2.1 Subjective sleep complaints in PTSD patients

Increased sleep onset latency, shorter sleep duration, increased number and duration of nocturnal awakenings, increased body movements during sleep, and difficulty returning to sleep after awakening from a nightmare are the sleep complaints most commonly reported by PTSD patients (Brown & Boudewyns, 1996; Glaubman et al., 1990; Horowitz et al., 1980; Hurwitz, Mahowald, Kuskowski, & Engdahl, 1998; Inman, Silver, & Godhramji, 1990; Krakow, Tandberg, Scriggins, & Barey, 1995c; Krakow et al., 2000a; Mellman et al., 1995a; Mellman et al., 1995b; Neylan et al., 1998; Ohayon & Shapiro, 2000; van der Kolk et al., 1984; Woodward, Arsenault, & Richardson, 1992). These findings support the contention that sleep disturbances are prominent in PTSD patients, and may be the core dysfunction in PTSD. By the same token, the apparent severity of these sleep complaints does not offer support for the adaptation hypotheses.

One study has reported that subjective sleep quality estimates by PTSD patients are not corroborated by objective sleep measures (Woodward, Bliwise, Friedman, & Gusman, 1996). More specifically, PTSD patients appear to underestimate sleep quality and total sleep time and overestimate sleep onset latencies and wake time after sleep onset compared to sleep measures collected with PSG. This suggests that PTSD patients underestimate their sleep quality in a manner somewhat similar to that of insomnia patients (e.g., Coté & Ogilvie, 1995; Epsie, Lindsay, & Epsie, 1988). This, in turn, implies that sleep complaints

reported by this cohort might be correlates of psychological distress rather than an expression of an underlying pathophysiological mechanism.

However, studies that have used PSG to investigate sleep profiles in PTSD patients tend to corroborate some of the subjective reports of sleep complaints. These studies offer support for both sleep-related hypotheses of PTSD.

2.2 Objective sleep profiles of PTSD patients

Objective empirical evidence for the presence of sleep disturbances in PTSD is inconsistent. Some studies suggest intensification of several REM sleep parameters in PTSD patients as suggested by reduced REM latencies (Greenberg, et al., 1972a; Kramer & Kinney, 1988; Dow et al., 1996), increased REM duration or percentage (Engdahl, Eberly, Hurwitz, Mahowald, & Blake, 2000; Ross, et al., 1994; Woodward, Murburg, & Bliwise, 2000), increased eye movement density (Mellman et al., 1995a; Mellman et al., 1997; et al., 1994), and increased phasic muscle events (Glaubman et al., 1990; Hefez, Meltz, & Lavie, 1987; Mellman et al., 1995a; Ross et al., 1994). These findings on REM sleep amplification support the core REM sleep dysfunction hypothesis of PTSD (Ross et al., 1989).

However, conflicting findings such as of decreased REM sleep activity, longer REM sleep latency (Kramer & Kinney, 1988; Hefez et al., 1987; Schlosberg & Benjamin, 1978; Glaubman et al., 1990) and decreased REM sleep duration and percentage (Astrom, Lunde, Ortmann, Boysen, & Trojaborg, 1989; Hefez et al., 1987) have also been reported. Additionally, the hypothesis proposing REM

sleep as a core dysfunction of PTSD has further been challenged by reports of NREM disturbances, such as increased nocturnal awakenings during all sleep stages (Lavie, Hefez, Halperin, & Enoch, 1979; Mellman et al., 1995b; van der Kolk et al., 1984), increased number of body movements (Glaubman et al., 1990; Mellman et al., 1995a; Mellman et al., 1995b), and elevated indices of period leg movements in sleep (Boudewyns & Brown, 1996; Ross et al., 1994). To explain these NREM sleep disturbances, several authors have suggested that all of the aforementioned NREM sleep anomalies are continuous with the pervasive waking hyperarousal exhibited by PTSD patients (Brown & Boudewyns, 1996; Mellman et al., 1995b; Ross et al., 1994).

Finally, other studies report a general absence of sleep disturbances in PTSD patients (Dagan, Lavie, & Bleich, 1991; Dadan, Zinger, & Lavie, 1997; Dow et al., 1996; Engdahl et al., 2000; Hurwitz et al., 1998; Lavie, Katz, Pillar, & Zinger, 1998; Woodward et al., 2000). Some have proposed a variant of the "core REM sleep dysfunction" hypothesis, that subjective sleep complaints, rather that objective REM sleep anomalies, are the hallmark of PTSD (Dow et al., 1996; Engdahl et al., 2000; Hurwitz et al., 1998)

Taken together, these observations indicate that sleep measures do not always corroborate the magnitude of sleep disturbance subjectively reported by PTSD patients. Nevertheless, they tend to demonstrate some degree of quantifiable sleep disturbances in PTSD patients. The nature of REM sleep disturbances is equivocal, and when sleep disturbances are observed, they are not necessarily REM sleep-specific. Such diffuse sleep anomalies may be the product of a process ongoing throughout the sleep period.

2.3 An alternative explanation for sleep disturbances in PTSD

The aforementioned inconsistencies may be attributable to the fact that current sleep-based hypotheses of PTSD have not explicitly made the distinction between REM sleep and nightmares. None of the previous studies have investigated whether PTSD patients reporting frequent nightmares (defined as an awakening accompanied by detailed frightening dream recall) exhibit sleep profiles different from those diagnosed with PTSD but who do not report nightmares.

Thus, an alternative explanation of the relationship between sleep disturbances is that sleep disturbances reported by PTSD patients are correlates of an underlying nightmare-specific disturbance, which may not be limited to REM sleep. Because nightmares consist of 1) awakenings from sleep, and 2) intense distressing affects, both components may disrupt sleep patterns in PTSD patients.

Verification of this explanation would require, in part, investigating whether PTSD patients reporting frequent nightmares exhibit sleep profiles different from patients with PTSD but who do not report nightmares. Recruiting PTSD patients who do not report disturbing dreams, however, may be a difficult task since 75% to 90% of PTSD patients report them. Thus, an alternative means of verifying the proposed explanation is to contrast the sleep profiles of nightmare patients with and without PTSD. Contrasting sleep profiles of PTSD patients with frequent nightmares (P-NM) with those of idiopathic nightmare patients (I-NM) may clarify whether sleep anomalies reported in PTSD patients are the product of an

underlying nightmare-related pathological mechanism, rather than the result of some factor inherent to PTSD. If sleep disturbances can arise from an underlying nightmare pathology, both P-NM and I-NM patients should exhibit more sleep anomalies that healthy individuals who do not report frequent nightmares. However, P-NM and I-NM would be expected to show similar sleep profiles.

Such a comparison may also provide preliminary clarifications on whether sleep disturbances in PTSD are associated with the awakening mechanism of nightmares or whether they arise from an abnormal intensification in the affective component. The study of the sleep characteristics of idiopathic nightmare (I-NM) patients offers a unique opportunity to discriminate whether sleep disturbances observed in PTSD patients are due to intrinsic psychophysiological processes inherent to PTSD, to the nightmare awakening mechanism, or to their intense negative affective nature. Idiopathic nightmares and associated sleep profiles are further described in the following section.

3. IDIOPATHIC NIGHTMARES

3.1 The definition and uncertain prevalence of idiopathic nightmares

The DSM-IV (APA, 1994) diagnostic category referring to non-PTSD-related nightmares, or idiopathic nightmares (Hartmann, 1984; Hartmann, Falke, Russ, Oldfield, Sivan, & van der Kolk, 1981a; Hartmann, & Russ, 1979; Hartmann, Russ, van der Kolk, Falke, & Oldfield, 1981b) is that of Nightmare Disorder. The following diagnostic criteria define Nightmare Disorder:

A. Repeated awakenings from the major sleep period or naps with detailed recall of extended and extremely frightening dreams, usually involving threats to survival, security, or self-esteem. The awakenings generally occur during the second half of the sleep period.

B. On awakening from the frightening dreams, the person rapidly becomes oriented and alert (in contrast to the confusion and disorientation seen in Sleep Terror Disorder and some forms of epilepsy).

C. The dream experience, or the sleep disturbance resulting from the awakening, causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

D. The nightmares do not occur exclusively during the course of another mental disorder (e.g. a delirium, Posttraumatic Stress Disorder), and are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition.

People who experience this type of nightmare sometimes report having experienced them since childhood, although they do not recall any preceding trauma. Surveys conducted in the general population suggest that between 4% and 8% of individuals report current problems with nightmares (Bixler, Kales, Soldatos, Kales, Healthy, 1979; Braz, Hirshkowitx, Tufik, & Neumann, 1990; Cirignotta, Zucconi, Mondini, Lenzi, & Lugaresi, 1983; Klink & Quan, 1987; Salvio et al., 1992). However, such estimates do not take into account the possibility that individuals reporting current nightmare complaints may also suffer from PTSD. Considering that 5% of community samples present current PTSD (Kilpatrick et al., 1994), and that a conservative estimate of nightmare prevalence in PTSD is 75%, 3.75% of the general population could report PTSD-related nightmares. This leaves, at best, a prevalence estimate of 0.25% to 4.25% of the general population who report non-PTSD related nightmare complaints.

In comparison to PTSD-related nightmares, idiopathic nightmares are typically quite varied in content and not necessarily recurrent. The occurrence of idiopathic nightmares appears to be limited to REM sleep episodes especially in the second half of the night (Fisher et al., 1970; Fisher, Kahn, Edwards, & Davis, 1973; Hartmann, 1984).

3.2 Subjective sleep complaints in I-NM patients

Some studies have investigated sleep complaints reported by I-NM patients. Nightmare sufferers have more sleep-related complaints such as increased sleep latencies and increased number of nocturnal awakenings than do control participants (Cellucci & Lawrence, 1978a; Hersen, 1971; Haynes & Mooney, 1975). Levin (1994) reported that students with frequent nightmares could be distinguished from students with few nightmares on a number of sleep-related variables. For instance, frequent nightmare sufferers reported lower levels of sleep quality and more nocturnal awakenings than students with infrequent nightmares. Differences between acute (< six-month duration) and chronic (> six-month duration) idiopathic nightmare patients have also been investigated (Krakow et al., 1995c). Acute nightmare sufferers report a greater fear of going to sleep than do chronic sufferers, whereas the latter group reports a higher frequency of nocturnal awakenings.

Therefore, these studies suggest that despite their distinct aetiologies, idiopathic nightmares and PTSD-related nightmares are associated with similar sleep complaints (e.g. longer sleep onset latencies, poor sleep quality, increased number of nocturnal awakenings). This, in turn, is consistent with the notion that a

common underlying nightmare-related pathology inducing or maintaining sleep disturbances may be present in both subgroups of nightmare patients

3.3 Objective sleep profiles of I-NM patients

Only three studies investigating sleep profiles in I-NM patients have used polysomnographic measures. One study of patients with three or more nightmares per week reported that 40% of nightmare reports were preceded by marked or moderate increases in heart rate, respiratory rate and REM density, whereas 60% were not (Fisher et al., 1970). Descriptions of sleep architecture of these patients was not provided although polysomnographic recordings were used. Only the increased heart rate has been replicated in a separate study (Nielsen, & Zadra, 2000). Another study (Newell, Padamadan, & Drake, 1992) has investigated the sleep patterns of I-NM patients with ambulatory recordings, and reported that they exhibited less total sleep time, more nocturnal awakenings and reduced slow-wave sleep compared to sleep norms (Williams, Karacan, & Hursch, 1974). Thus, I-NM patients seem to present anomalies that are also reported in PTSD patients (e.g., increased number of nocturnal awakenings). This further reinforces the contention that sleep disturbances in both subgroups of nightmare patients (P-NM and I-NM) may arise from a single underlying nightmare pathology.

Only one study (van der Kolk et al., 1984) has investigated sleep complaints in P-NM (N = 15) and I-NM (N = 10) patients. They found that PTSD nightmares tend to occur earlier in the night, are more frequent, and are more often associated with gross body movements than is the case for idiopathic

nightmares. However, a lack of objective sleep measures obviates the possibility of determining whether these two groups had similar types of sleep disturbances apart from the nightmares. In fact, to this day, no study has investigated whether PTSD patients who also report frequent nightmares differ from idiopathic nightmare sufferers on laboratory-recorded sleep parameters.

3.4 Summary

To reiterate, the numerous similarities in sleep profiles of I-NM and P-NM patients (e.g., poor sleep quality, longer sleep latencies, and increased number and duration of nocturnal awakenings) indicate that sleep disturbances in both groups arise from a common underlying nightmare-related pathological mechanism, despite their distinct aetiologies. To this day, no study has assessed whether the frequent occurrence of nightmares may contribute to sleep disturbances in both P-NM and I-NM patients. Consequently, comparing the sleep characteristics of P-NM and I-NM patients offers a unique opportunity to determine whether the sleep disturbances observed in PTSD patients are due to intrinsic psychophysiological processes inherent to PTSD, or to the nightmare pathology itself.

Consistent with the observation that sleep disturbances observed in PTSD are also observed in I-NM patients, I hypothesize that sleep disturbances reported by PTSD patients are related to an underlying nightmare-specific mechanism. Accordingly, I-NM and P-NM patients are expected to demonstrate similar objectively measured sleep profiles when compared with healthy control participants. If, on the other hand, sleep disturbances in PTSD are related to

factors inherent to PTSD, the two subgroups of nightmare patients should show different sleep characteristics. Thus, the goal of the first study presented in this dissertation is to investigate this possibility, i.e., whether I-NM and P-NM patients exhibit different sleep profiles based on polysomnographic recordings.

The proposed explanation further implies that if sleep disturbances are correlates of a nightmare pathology, nightmare alleviation should be associated with alteration of the sleep profiles in both subgroups of nightmare patients. Several case studies have demonstrated that a wide variety of cognitive-behavioural treatments such as desensitization (Burgess, Marks, & Gill, 1994; Cavior & Deutsch, 1975; Geer & Silverman, 1967; Shorkley & Himle, 1974), hypnosis (Eichelman, 1985; Gorton, 1988; Kingsbury, 1993; Seif, 1985), lucid dreaming (Abramovitch, 1995; Brylowski, 1990; Zadra & Pihl, 1997), eye movement desensitisation and reprocessing (EMDR; Marquis, 1991; Pellicer, 1993; Puk, 1991, Shapiro, 1989a, 1989b), and imagery rehearsal (Bishay, 1985; Halliday, 1982; Marks, 1978) are markedly effective in reducing nightmare frequency. Other psychological approaches have also been used and reported only anecdotally (see Coalson, 1992; Halliday, 1987 for a review). In the following sections, I review 1) cognitive-behavioural interventions for which controlled studies have been conducted to assess their efficacy at alleviating nightmares, 2) the impact of these interventions on symptoms of psychological distress, and 3) their impact on sleep quality. The rationale for selecting imagery rehearsal in this dissertation project is then discussed.

4. Cognitive-Behavioural Treatments for Nightmare Alleviation

4.1 Desensitization

The rationale for using desensitization for alleviating nightmares is that a nightmare is a manifestation of anxiety that can be extinguished in response to psychological interventions known to alleviate anxiety in the waking state (Geer & Silverman, 1967; Miller & DiPilato, 1983). Two controlled studies have assessed the efficacy of desensitization in reducing nightmare frequency, nightmare intensity, psychological symptoms (e.g., anxiety, fear, depression, hostility, and general psychological distress), and sleep complaints. In the first study, Cellucci & Lawrence (1978b) compared the reductions in nightmare frequency and intensity, state and trait anxiety, and improvements in sleep quality for three treatment conditions: a desensitization group, a nightmare discussion group, and a nightmare recording control group with students who reported two or more nightmares per week. Participants in the first two treatment groups were seen individually and weekly for five 40-to-60 minute sessions. At one-month and seven-month follow-up assessments, participants in the desensitization condition demonstrated reduced nightmare frequency and intensity compared to the other two groups post-treatment. Furthermore, only participants in the desensitization condition reported reduced sleep onset latencies and demonstrated lower state anxiety scores post-treatment. No changes in trait anxiety were observed for any of the groups post-treatment.

In the second controlled study (Miller & DiPilato, 1983), thirty-two adults reporting at least one nightmare per month were randomly assigned to one of three treatment conditions: desensitization, relaxation, or a wait-list control condition. Measures included a fear questionnaire, the Profile of Mood State (POMS; McNair, Lorr, & Droppelman, 1971, cited in Miller in DiPilato, 1983), and prospective sleep logs. Participants in the first two treatment conditions were seen weekly and individually for six consecutive weeks, in 40-to-75 minute sessions. Nine weeks after treatment completion, the two treated groups showed significant nightmare frequency reduction compared to the wait-list control group. However, these two groups did not differ from one another. Nightmare intensity remained unchanged in all three groups. Sixteen weeks later, nightmare reduction was maintained for both treated groups, however, those who received the desensitization treatment exhibited significant reduction in nightmare intensity. Scores on the fear questionnaire and the POMS, as well as sleep onset latencies and total sleep time, remained unchanged post-treatment in all groups.

Thus, desensitization and relaxation are equally effective at alleviating nightmare frequency, but only desensitization has been associated with reductions in nightmare intensity. With regards to alleviating anxiety and mood symptoms, however, the two aforementioned studies diverge. The discrepancies may be attributable to the nightmare criterion used for selecting participants in each study (one or more nightmares/week in Cellucci & Lawrence, 1978; and one nightmare per month in Miller & DiPilato, 1983). Possibly, patients who report more nightmares may also exhibit higher baseline levels of psychological symptoms and sleep disturbances than those who report fewer nightmares. Controlled studies on the efficacy of imagery rehearsal conducted with patients

reporting one or more nightmares per week support this suggestion (see section 4.2).

The efficacy of both desensitization and relaxation for alleviating PTSD-related nightmares, however, has never been assessed in controlled clinical trials. Furthermore, exposure to distressing dream content may be especially difficult for PTSD patients, who typically avoid reliving and thinking of negative experiences (APA, 1994). Imagery rehearsal, on the other hand, does not involve exposure to distressing material, and has been shown to be as effective as the combination of desensitization and relaxation.

4.2 Imagery rehearsal

The first anecdotal account of imagery rehearsal for alleviating nightmares was reported by Marks (1978). Marks described the case of a woman who had had a recurrent nightmare and depressive symptoms for 14 years, and whose nightmare and depressive mood were alleviated after relating the integral nightmare three times followed by the imaginal rehearsal of a triumphant ending to the initial nightmare. The author suggested that there were 3 possible psychological components involved in nightmare alleviation using dream imagery rehearsal: exposure, abreaction, and increase in the sense of mastery over the distressing dream content. For Marks (1978), exposure and abreaction were most likely to be the critical components of therapeutic success.

However, a series of controlled studies conducted with both I-NM and P-NM patients demonstrated that rehearsing new dream scenarios with neither

exposure nor abreaction was also effective at alleviating nightmares with patients reporting at least one nightmare per week. It was further demonstrated that increasing the patients' sense of mastery over distressing dream content seems to be the most potent psychological explanation of why imagery rehearsal is effective for alleviating both nightmares and waking psychological distress (Germain, Krakow, Faucher, Zadra, & Nielsen, 2000).

In the first study of this series, the efficacy of imagery rehearsal for alleviating nightmares and symptoms of psychological distress was compared to a control, nightmare recording, condition (Neidhardt, Krakow, Kellner, & Pathak, 1992). Psychological distress was assessed using the Symptom Questionnaire, which includes four subscales of symptoms of anxiety, depression, hostility and somatization (SQ; Kellner, 1987). The imagery rehearsal condition consisted of a single group session, during which participants were instructed to choose one of their previous nightmares, to change this nightmare in any way they wished, to write the new version of the dream and finally, to mentally rehearse this new dream scenario. Participants were then instructed to practice this technique at home. Participants in the nightmare recording condition completed a nightmare log for one month. Unexpectedly after four months, both groups exhibited significant reductions in nightmare frequency. To explain the lack of differences between the two conditions, the authors suggested that recording nightmares might be an effective form of desensitization therapy. However, at follow-up, psychological distress and all subscales of the SQ were significantly reduced in patients in the imagery rehearsal group only. A thirty-month follow-up was conducted with these two groups of patients (Krakow, Kellner, Neidhardt, Pathak, & Lambert, 1993). Nightmare frequency reductions were still maintained and

similar for the two conditions (imagery rehearsal and nightmare recording). However, only the group who received imagery rehearsal maintained reductions in psychological distress.

A second comparison of the efficacy of imagery rehearsal and a wait-list control condition for alleviating nightmare frequency (Krakow, Kellner, Pathak, & Lambert, 1995a), sleep disruption (measured with a visual analogue scale), and symptoms of psychological distress revealed that only imagery rehearsal is associated with significant improvements in nightmare frequency and sleep quality post-treatment. Furthermore, significant reductions on the SQ scores of total distress, anxiety, depression and somatization were observed only in the group who received imagery rehearsal. A third study compared the efficacy of a single imagery rehearsal treatment session with a combination of desensitization and relaxation, and a nightmare recording only control condition (Kellner, Neidhardt, Krakow, & Pathak, 1992). Both treatments were delivered in a single group session. Four months and seven months post-treatment, the two treatment groups showed significant and comparable reductions in nightmare frequency compared to the recording condition. Improvements were maintained at the seven-month follow-up, and the two treatment conditions did not differ.

Recently, the efficacy of imagery rehearsal for alleviating nightmares and improving sleep was again demonstrated in a controlled study with sexual assault survivors with PTSD who reported at least one nightmare per week (Krakow et al., 2000b). More specifically, women with PTSD who practiced imagery rehearsal reported a decreased nightmare frequency, reduced PTSD severity, and

increased sleep quality three months post-treatment compared with women in a wait-list control group.

Thus, imagery rehearsal is effective at alleviating nightmares, symptoms of psychological distress (i.e., anxiety, depression, hostility, and somatization), and sleep complaints in individuals who report at least one nightmare per week. These effects have been observed in both I-NM and P-NM patients. This suggests that nightmare alleviation by imagery rehearsal may affect a waking state psychological process as well as a specific sleep-related process.

4.3 Rationale for selecting imagery rehearsal

Imagery rehearsal is as effective as the combination of desensitization and relaxation therapies. Moreover, this technique offers the advantages of being delivered in a group format and in a single session. Marked reductions in nightmare frequency have been reported after 2 to 12 weeks of home practice (Kellner et al., 1992; Neidhardt et al., 1992), and improvements are maintained for as long as 30 months. Additionally, imagery rehearsal has been shown to effectively relieve idiopathic and PTSD-related nightmares (Kellner et al., 1992; Krakow et al., 1995a, 1995b; Krakow et al., 2000b; Neidhardt et al., 1992). Finally, because imagery rehearsal does not involve exposure to distressing material, it may facilitate treatment adherence in P-NM patients. For all these reasons, imagery rehearsal was selected for study in the present project.

Nevertheless, some limitations for the use of imagery rehearsal require clarification. First, studies on the efficacy of imagery rehearsal for alleviating

nightmares have never been independently replicated. Second, prospective home dream logs have not been used to ascertain reductions in nightmare frequency. This is especially important given that retrospective nightmare frequency estimates are much lower than those collected with prospective home logs in both healthy subjects (Salvio et al., 1992; Wood & Bootzin, 1990; Zadra & Donderi, 2000) and sexual abuse survivors (Penn, Bootzin, & Wood, 1992). Similarly, reports of sleep improvements associated with nightmare alleviation using imagery rehearsal are based on retrospective self-report measures. Thus, objective assessments of sleep changes using polysomnographic recordings following nightmare alleviation are needed.

The principal goal of the second study presented in this dissertation is to independently replicate the efficacy of imagery rehearsal for alleviating nightmares in P-NM and I-NM patients using prospective measures of nightmare frequency. The second goal is to investigate whether nightmare alleviation is associated with quantifiable sleep improvements.

Returning to the proposed explanation regarding the potential role of nightmares in producing the sleep disturbances seen in PTSD patients, the treatment studies reviewed above are consistent with the possibility that imagery rehearsal may have an impact on either the affective component of disturbing dreams (which then generalizes to psychological aspects of well-being) or on the awakening mechanism associated with nightmares (which then reduces sleep disruption). According to the proposed explanation, nightmare alleviation with imagery rehearsal is expected to be associated with a reduction in symptoms of

depression and anxiety and with quantifiable sleep improvements (e.g., reduced number of nocturnal awakenings and increased sleep efficiency)

5. Summary

Sleep disturbances and nightmares have long been recognized as core symptoms of PTSD. Based on the prevalence of sleep complaints and disturbing dreams in PTSD patients, sleep-based hypotheses about the pathogenesis of PTSD have been proposed. These hypotheses, however, receive conflicting support from the research literature, and none of the available studies has investigated the role of disturbing dreams in PTSD sleep disturbances. An alternative explanation emphasizes the potential role of nightmares in producing sleep anomalies observed in PTSD patients. This explanation also suggests that nightmare alleviation should be accompanied by quantifiable sleep improvements in nightmare patients. On the one hand, if nightmares produce sleep disturbances in both P-NM and I-NM patients, then nightmare alleviation should lead to comparable sleep improvements in both nightmare groups. On the other hand, if the nightmare aetiology determines the pattern of sleep disruption, nightmare alleviation should be accompanied by different sleep changes in P-NM and I-NM patients.

The general objectives and specific hypotheses investigated in the two studies forming the core of the present dissertation are detailed in the following section.

II. General Objectives and Specific Hypotheses

Study 1. Sleep pathophysiology in PTSD and idiopathic nightmare patients

The first objective is to investigate whether specific sleep profiles are associated with the experience of frequent nightmares (i.e., more than one per week) in two different subgroups of nightmare patients, i.e., P-NM and I-NM patients, and to determine whether these sleep patterns differ from those observed in healthy control participants (CTL). The specific hypothesis is:

Hypothesis 1: P-NM and I-NM patients will show more objectively measured sleep disturbances than will age- and sex-matched healthy control participants (CTL). Specifically, both P-NM and I-NM patients are expected to exhibit longer SOL, reduced TST and SE, increased duration and number of nocturnal awakenings, and increased WASO compared to CTL participants.

Study 2. Polysomnographic changes in PTSD and idiopathic nightmare patients with imagery rehearsal

The objectives of the second study presented in this dissertation are 1) to independently replicate the efficacy of imagery rehearsal for alleviating nightmares, and 2) to investigate whether nightmare alleviation is associated with prospective reductions in nightmare frequency, reduction in symptoms of depression and anxiety, and quantifiable sleep improvements. The specific hypotheses related to these objectives are:

Hypothesis 2: Post-treatment, retrospective estimates of nightmare frequency and symptoms of anxiety and depression will be significantly reduced compared to pre-treatment estimates; prospective frequency estimates of nightmares, bad dreams, and sleep terrors will also be reduced.

Hypothesis 3: Post-treatment, nightmare patients will show improvements in sleep quality compared to pre-treatment sleep measures. Specifically, reductions in SOL, duration and number of nocturnal awakenings, WASO, and increases in TST and SE are expected post-treatment.

Article 1

Sleep pathophysiology in PTSD and idiopathic nightmare sufferers

SLEEP PATHOPHYSIOLOGY IN PTSD AND IDIOPATHIC NIGHTMARE SUFFERERS

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ABSTRACT

Background: Nightmares are common in posttraumatic stress disorder (PTSD) but also frequently occur in idiopathic form. Findings associated with sleep disturbances in these two groups have been inconsistent. The present study aims at investigating whether sleep anomalies in PTSD sufferers with frequent nightmares (P-NM) differ from those observed in non-PTSD, idiopathic nightmare (I-NM) sufferers and healthy individuals. **Methods:** Sleep measures were obtained from nine P-NM patients with frequent nightmares, 11 I-NM patients, and 13 healthy control subjects (CTL). All participants slept in the laboratory for two consecutive nights where EEG, EOG, chin and leg EMG, ECG, and respiration were recorded continuously. **Results:** P-NM patients had significantly more nocturnal awakenings than did I-NM patients and CTL subjects. Elevated indices of periodic leg movements (PLM) during REM and NREM sleep characterized both P-NM and I-NM patients. **Conclusion:** That P-NM patients exhibit more nocturnal awakenings than do I-NM patients and CTL subjects supports the hypothesis of hyperarousal in sleep in PTSD patients. However, elevated PLM indices in both P-NM and I-NM sufferers suggest that PLM may not be a marker of hyperarousal in sleep of PTSD patients. Rather, PLM may be a correlate of processes contributing to intense negative dreaming.

INTRODUCTION

REM sleep disturbances and nightmares have been suggested to be the hallmark of posttraumatic stress disorder (PTSD; Ross, Ball, Sullivan, & Caroff, 1989). Findings regarding changes in sleep architecture among PTSD patients are equivocal, however, and no profile of sleep disturbances unique to PTSD has yet been established. Some studies suggest intensification of several REM sleep parameters in PTSD patients as indicated by reduced REM latency (Dow, Kelsoe, & Gillin, 1996; Greenberg, Perlman & Gambel, 1972; Kramer & Kinney, 1988), increased REM duration or percentage (Engdahl, Eberly, Hurwitz, Mahowald, & Blake, 2000; Ross et al., 1994), increased eye movement density (Mellman, David, Kulik-Bell, Hebding, & Nolan, 1995a; Ross et al., 1994), and increased phasic muscle events (Glaubman, Mikulincer, Porat, Wasserman, & Birger, 1990; Hefez, Meltz, & Lavie, 1987; Mellman et al., 1995a; Ross et al., 1994). Increased nocturnal awakenings during all sleep stages (Lavie, Hefez, Halperin, & Enoch, 1979; Mellman, Kulick-Bell, Ashlock & Nolan, 1995b; van der Kolk, Blitz, Burr, Sherry, & Hartmann, 1984), increased number of body movements (Glaubman et al., 1990; Mellman et al., 1995a; Mellman et al., 1995b), and elevated indices of period leg movements have also been observed (Boudewyns & Brown, 1996; Ross et al., 1994).

However, markers of decreased REM sleep activity, such as longer REM sleep latency (Kramer & Kinney, 1988; Hefez et al., 1987; Schlosberg & Benjamin, 1978; Glaubman et al., 1990) and decreased REM sleep duration and percentage (Astrom, Lunde, Ortmann, Boysen, & Trojaborg, 1989; Hefez et al., 1987) have also been reported. Moreover, some studies report an absence of

sleep disturbances in PTSD patients (Dagan, Lavie, & Bleich, 1991; Dagan, Zinger, & Lavie, 1997; Hurwitz, Mahowald, & Kuskowski, & Engdhal, 1998; Lavie, Katz, Pillar, & Zinger, 1998).

A confounding factor that may explain such discrepant findings in sleep measures in PTSD is the concurrent experience of frequent nightmares. Nightmares are part of the intrusion symptom cluster of PTSD (APA, 1994) and are reported by 75%-90% of this population, depending on the time of post-trauma assessment (Horowitz, Wilner, Kaltreider, & Alvarez, 1980; Kilpatrick et al., 1994; Riggs, Rothbaum, & Foa, 1995; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). Two studies suggest that individuals reporting frequent nightmares but not PTSD may nevertheless exhibit the same sleep anomalies observed in PTSD patients. One study of patients with 3 or more nightmares per week, either post-traumatic or idiopathic in nature (Fisher, Byrne, Edwards, & Kahn, 1970), reported that 40% (8/20) of nightmare reports were preceded by marked or moderate cardiorespiratory increases and an increased density of ocular movements. Sleep architecture for these patients, however, was not described, implying that no sleep anomalies were apparent. Another study (Newell, Padaman, & Drake, 1992) investigated the sleep patterns of individuals who reported frequent nightmares, and found that they exhibited sleep changes similar to those observed in PTSD patients, such as less total sleep time (Astrom et al., 1989; Dow et al., 1996; Hefez et al., 1987; Lavie et al., 1979; van Kammen, Christiansen, van Kammen, Fuderich, Houck & Reynolds, 1987), more nocturnal awakenings (Mellman et al., 1995a; 1995b; Hefez et al., 1987; Astrom et al., 1989; Hurwitz et al., 1998; Engdahl et al., 2000; Schloesberg & Benjamin, 1978), and reduced slow-wave sleep (Schloesberg & Benjamin, 1978; Hefez et al., 1987;

Astrom et al., 1989; Woodward, Friedman & Bliwise, 1996; Peters, van Kammen, van Kamme & Neylan, 1990). Thus, at least two studies suggest that idiopathic nightmare sufferers may exhibit sleep anomalies that have been reported for PTSD patients. This supports the contention that sleep disturbances in PTSD patients may be more a function of nightmare psychopathology, rather than other more global PTSD processes.

Alternatively, one study (van der Kolk et al., 1984) investigating sleep complaints in both nightmare sufferers with PTSD (N = 15) and individuals with idiopathic nightmares (N = 10) found, with subjective measures, that PTSD-related nightmares tend to occur earlier in the night, are more frequent, and are more often associated with gross body movements than are idiopathic nightmares. However, a lack of objective sleep measures obviates the possibility of determining more specifically whether these two groups had different types of sleep disturbances. In fact, no study has ever investigated whether PTSD patients with frequent nightmares differ from idiopathic nightmare sufferers on laboratory-recorded sleep parameters. Idiopathic nightmare sufferers offer a unique opportunity to determine whether the sleep disturbances observed in PTSD patients are due to intrinsic pathophysiological factors proper to PTSD, or to nightmare pathophysiology alone. Thus, the goal of the present study was to investigate whether the sleep attributes of PTSD patients with frequent nightmares differ from those of either idiopathic nightmare sufferers or healthy participants matched for age and sex.

METHODS

Participants

Nightmare sufferers were recruited mainly from advertisements in the University of Montreal's campus newspaper and following a short televised documentary on the laboratory study of nightmares that aired in the evening. To enter the study, participants had to be at least 18 years of age and to report recalling more than one nightmare per week for a minimum of 6 months. They were excluded if 1) they were currently under medications known to influence sleep and dreams, 2) they were currently suffering from a major psychiatric disorder other than PTSD, 3) they reported currently suffering from another sleep problem, 4) they suffered from a neurological disorder 5) they reported irregular sleep-wake schedules or had undergone jet lag in the previous three months, 6) they reported using alcohol or drugs on a regular basis, or 7) they were currently engaged in legal proceedings involving events related to their nightmares. Nine individuals with PTSD and nightmares (P-NM; 4 men and 5 women, M age = 39.0 $\pm$ 12.1 years) and 11 individuals with idiopathic nightmares (I-NM; 5 men and 6 women; M age = 28.2 $\pm$ 5.3 years) met these criteria and participated in the study. PTSD status was determined using the Posttraumatic Symptom Scale (PSS; Foa, Dancu, & Rothbaum, 1993) and the Clinician's Assessment of Posttraumatic Stress (CAPS; Blake et al., 1993). Table 1 presents information on the age, gender, nightmare chronicity, trauma and PTSD severity (when applicable) of all patients. Four of the I-NM patients also reported past traumatic events but the onset of nightmares was determined to precede the trauma in all cases. None of these met the criteria for past or current PTSD. Three P-NM patients (1,2 and 9)

met the criteria for current depressive episodes in the severe range. Only one I-NM patient (patient 1) reported a history of substance abuse whereas none of the PTSD patients did.

Seven men and 6 women (Mean age = 32.6 ± 11.2) comprised the control group (CTL) and also met the aforementioned inclusion and exclusion criteria. They were free of sleep and dreaming disturbances, and were recruited from an advertisement in the same university newspaper. These subjects were paired for age and sex to the I-NM and P-NM patients.

The Sacre-Coeur Hospital Ethics Committee approved the study. Written and oral consent was obtained from all participants.

Insert Table 1 about here

Polysomnography

All participants slept in the laboratory for two consecutive nights. Sleep recordings were performed with a 32-channel montage that measured EEG with the international 10-20 electrode placement system (FP1, FP2, F3, F4, F7, F8, C3, C4, T3, T4, T5, T6, P3, P4, O1, O2, Fz, Cz, Pz), eye movements (LOC-A2; ROC-A1), EMG (submental and right tibialis), oral-nasal airflow, and ECG. A referential montage (with linked ears reference) was used to record the 19 EEG channels. Recordings were performed using RHYTHM version 10.0 (Stellate

Systems, 1995) and were scored manually according to Rechtschaffen and Kales (1968) criteria using HARMONY version 4.1 (Stellate Systems, 1999) by an experienced polysomnographic technician who had not conducted the sleep recordings and who was blind to the purpose of the study. Sleep onset latency (SOL) was computed as the interval between lights out and the first episode of any sleep stage. Periodic leg movements were scored according to Coleman's criteria (1982), and the periodic leg movement (PLM) indices were computed as the number of PLM X 60 / number of minutes of sleep. REM density was computed as the absolute number of rapid eye movements (REM; Tachibana, Sugita, Terashima, Teshima, Shimiza, & Hishikawa, 1992) during the last five minutes of each REM sleep episode, and then averaged over all REM sleep episodes. Micro-arousals were identified as abrupt changes in EEG frequency, with a minimal duration of 3 seconds and a maximal duration of 10 seconds, and could include alpha or theta frequencies but not spindles. A minimal interval of continuous sleep of 10 seconds was necessary to score a second micro-arousal (ASDA, 1992). The first night was considered an adaptation night, and only results collected from the second night are reported. Bedtime was between 22:00 and midnight depending on each participant's usual bedtime. The morning awakening was conducted between 06:00 and 08:00, again, depending on each participant's typical schedule. In the morning, electrodes were removed and participants were free to go for the day. Prior to leaving after the first recording night, they were reminded to avoid caffeine consumption and naps during that day. All participants received a monetary compensation of 20$ per night slept in the laboratory.

Statistical Analyses

Statistica 5.1 software (StatSoft, 1996) was used. When assumptions of homogeneity of variance and distribution normality were not respected, Kruskal-Wallis ANOVAs were conducted, and Mann-Whitney U tests were performed for post-hoc comparisons. Otherwise, one way ANOVAs were computed and Neuman-Keuls post-hoc comparisons were performed.

RESULTS

Polysomnography (PSG)

Mean PSG scores for the three groups are presented in Table 2. The groups differed significantly on the total number of nocturnal awakenings ($H_{2, N=33} = 6.00$, $p < 0.05$). The P-NM group exhibited more nocturnal awakenings than both I-NM and CTL groups ($p = 0.03$ for both), and the latter two groups did not differ. Wake time after sleep onset (WASO) tended to differentiate groups ($H_{2, N=33} = 5.08$, $p = 0.08$). The P-NM group demonstrated more WASO than the CTL group ($p = 0.04$) and marginally more WASO than the I-NM group ($p = 0.07$). Again, the I-NM and CTL groups did not differ on this measure.

Insert Table 2 about here

Mean percent sleep stage scores are presented in Table 3. Percent stage 4 sleep differed across the three groups ($H_{2\ N=33} = 7.67$, $p = 0.02$), with the I-NM group showing more %S4 sleep than the P-NM group ($p = 0.01$). However, neither NM group differed from the CTL group. No other sleep measures differentiated the groups.

Insert Table 3 about here

Periodic Leg Movements during Sleep

Table 4 presents results for periodic leg movements (PLM) in REM and NREM sleep. Differences across the three groups were found for all PLM indices, with and without associated micro-arousals, in both REM and NREM sleep. In all cases, P-NM and I-NM patients exhibited elevated PLM indices compared to CTL but did not differ from one another.

Insert Table 4 about here

DISCUSSION

Overall, few differences were observed in the sleep characteristics of P-NM, I-NM and CTL subjects, whereas both groups of nightmare patients differed in some respects from CTL participants. Consistent with other studies (Engdahl et al., 2000; Kramer & Kinney, 1988; Lavie et al., 1979; Mellman et al, 1995b; Scholesberg & Benjamin, 1978; van der Kolk et al., 1984; Woodward et al., 1996), P-NM patients exhibited more and lengthier nocturnal awakenings than did CTL subjects and similar tendencies were observed compared to I-NM patients. The increased number of nocturnal awakenings may explain the slightly increased WASO and reduced sleep efficiency observed in P-NM patients compared to both I-NM patients and CTL subjects, and further supports for the hypothesis that a lowered arousal threshold characterizes sleep in PTSD (Ross et al., 1989; Brown & Boudewyns, 1996; Mellman et al., 1995a, 1995b).

However, the finding that all PLM indices were elevated in both groups of nightmare patients relative to CTL subjects does not support the hypothesis that PLMs are a correlate of hyperarousal in P-NM patients (Brown & Boudewyns, 1996; Ross et al., 1989, Ross et al., 1994). Furthermore, examination of the PLMS inter-movement intervals indicated that gross body movements, as well as PLMS may be more frequent in both groups of nightmare patients. This may mean that sleep PLMs pathophysiology (and gross body movements as well) in PTSD is a function primarily of the frequent occurrence of nightmares. This is not to say that leg or body movements are correlates of nightmare content, in a manner analogous to the motor correlates of REM-sleep behavior disorder (RBD; Mahowald & Schenck, 2000), but rather to claim that the movements may reflect

an underlying disposition or system dysfunction that produces intense negative dreaming both in and out of PTSD. Ross et al. (1994) have suggested that increased leg movements in REM sleep indicate "abnormal central motor activation patterns in PTSD translated at higher cortical levels into vivid terrifying dream imagery". The present findings raise the possibility that such abnormal central motor activation patterns also exist in I-NM patients. Alternatively, it is possible that posttraumatic nightmares and idiopathic nightmares share some etiological mechanisms related to prior trauma (Epstein, Fullerton, & Ursano, 1998; Emery, Emery, Shama, Quiana, & Jassani, 1991; Green, 1994). However, this latter possibility is less likely, given that I-NM patients gave very little evidence of past major trauma. Nevertheless, it is possible that an accumulation of past minor stresses, perhaps very early in life, may lead to the development of idiopathic nightmares. This is consistent with a recent study that reported strong correlations between the frequency of disturbing dreams and DSM-III anxiety disorders (Nielsen, Laberge, Paquet, Tremblay, Virato, & Montplaisir, 2000). An alternative possibility is that intense negative dreaming facilitates periodic leg activity by releasing motor inhibition in sleep. This hypothesis is supported by reports of increased leg activity associated with laboratory-recorded nightmare episodes (Ross et al., 1994).

The significant difference between P-NM and I-NM patients in %S4 sleep likely represents an age effect. Indeed, a significant reduction in slow-wave sleep between early adulthood (16-25 years of age) and middle age years (36-50 years of age) has been reported (Van Cauter, Leproust, & Plat, 2000). Given that the two NM groups fell into these two distinct age groups, the difference between P-

NM and I-NM patients in %S4 sleep likely reflects a robust age-related decrease in slow-wave sleep.

To our knowledge, this is the first study to investigate the pathophysiology of sleep in non-war related P-NM patients in comparison to I-NM patients and healthy individuals. The results support the sleep hyperarousal hypothesis for PTSD in that P-NM patients exhibited more and longer nocturnal awakenings than did the other two groups. Periodic leg movements appear to be associated with to the recurrent experience of disturbing dreams in both P-NM and I-NM patients. If disturbing dreams and periodic leg movements arise from a common dysfunctional mechanism, we would expect nightmare alleviation using a cognitive-behavioral technique to be accompanied by a significant reduction in periodic leg movements in these two groups of nightmare sufferers, and to corroborate subjective improvements in sleep following nightmare alleviation (Kellner, Neidhardt, Pathak & Lambert, 1993; Krakow, Kellner, Neidhardt, Pathak & Lambert, 1993; Krakow et al., 2000). We also have preliminary evidence for this hypothesis (Germain & Nielsen, unpublished manuscript).

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Table 1. Descriptive information on PTSD nightmare (P-NM) and idiopathic nightmare (I-NM) patient in this study.

	Sex	Age	NM chronicity*	Trauma	PTSD Severity	PTSD Chronicity (years)
P-NM						
1	M	28	3	Car crash	Severe	3
2	F	46	4	Rape	Severe	4
3	F	58	53	Sexual abuse ‡	Severe	14
4	M	35	25	Physical abuse ‡	Moderate	25
5	F	40	10	Physical and sexual abuse †	Moderate	10
6	F	40	3	Rape	Moderate	3
7	M	46	20	Parachute accident	Moderate	20
8	F	22	5	25-foot fall	Moderate	5
9	M	36	2.5	Physical assault	Severe	2
I-NM						
1	F	36	30	Kidnapped ‡	None	
2	M	19	13			
3	M	30	10			
4	F	27	9	Father was shot	None	
5	M	36	25			
6	M	24	19	Witnessed armed robbery	None	
7	F	25	13			
8	F	30	25	Intruder in the house	None	
9	M	29	24			
10	F	31	2			
11	F	23	2.5			

* Nightmare chronicity did not differ between groups.

‡ Trauma occurred in childhood

† Trauma occurred in adolescence

Table 2. Mean PSG scores for the three study groups.

	P-NM (P) (N = 9)		I-NM (I) (N = 11)		CTL (C) (N =13)		H Statistic (df = 2)	Mann-Whitney Comparisons
	M	SD	M	SD	M	SD		
SOL	11.7	8.5	14.0	17.2	11.2	13.1	0.86	
TST	376.0	48.1	328.5	101.0	403.0	65.7	3.90	
WASO	70.6	61.2	30.9	13.9	31.2	24.2	5.08 (p = 0.08)	P > C, p = 0.04 P > I, p = 0.07
# Awakenings	44.8	21.3	25.4	9.7	26.5	9.7	6.00 (p =0.05)	P > C, p = 0.03 P > I, p = 0.03
REM Latency	83.4	27.2	82.3	31.9	99.0	6.6	0.57	
Sleep Efficiency	85.1	11.5	92.1	3.3	92.7	5.8	5.93 (p = 0.05)	P < C, p = 0.03 P < I, p = 0.09
REM Efficiency	79.1	17.1	90.8	9.1	87.7	11.0	3.64	
REM Density	5.4	4.7	6.8	7.2	4.4	3.8	0.47	
Micro-arousals	8.6	5.3	6.6	3.2	8.3	4.2	0.30	

Table 3. Average percent sleep stages for the three study groups.

	P-NM (P) (N = 9)		I-NM (I) (N = 11)		CTL (C) (N =13)		H Statistic (df = 2)	Mann-Whitney Comparisons
	M	SD	M	SD	M	SD		
%S1	12.2	5.6	8.2	3.1	8.4	4.2	4.04	
% S2	64.5	7.3	60.6	8.6	64.2	4.4	1.59	
% S3	3.6	3.7	8.4	4.9	5.1	3.9	5.20 (p = 0.07)	P < I, p = 0.04
% S4	0.2	0.4	1.7	2.7	0.8	1.5	7.67 (p = 0.02)	P < I, p = 0.01
% REM	19.5	5.1	21.2	4.4	21.5	3.6	2.06	

Table 4. Mean scores and SD for periodic leg movements (PLM) in REM and NREM sleep, with and without micro-arousals (MA) for the three study groups.

	P-NM (P) (N = 9)		I-NM (I) (N = 11)		CTL (C) (N =13)		H Statistics (df = 2)	Mann-Whitney Comparisons
	M	SD	M	SD	M	SD		
PLM	7.0	5.6	8.8	8.9	1.9	2.7	11.45 (p = 0.003)	P > C, p = 0.008 I > C, p = 0.003
PLM + MA	2.1	1.7	1.9	1.2	0.6	0.9	9.56 (p = 0.01)	P >C, p = 0.01 I > C, p = 0.01
REM PLM	14.2	8.6	18.61	17.9	5.2	9.1	10.18 (p = 0.006)	P > C, p = 0.01 I > C, p = 0.008
REM PLM + MA	2.7	2.7	1.8	1.8	0.5	1.0	6.09 (p = 0.05)	P > C, p = 0.07 I > C, p = 0.05
NREM PLM	5.2	4.9	5.7	7.9	1.0	1.4	8.45 (p = 0.01)	P > C, p = 0.01 I > C, p = 0.02
NREM PLM + MA	1.9	1.5	1.7	1.4	0.6	1.0	8.54 (p = 0.01)	P > C, p = 0.01 I > C, p = 0.02

Article 2

Polysomnographic Changes in PTSD and Idiopathic Nightmare Patients with Imagery Rehearsal

POLYSOMNOGRAPHIC CHANGES IN PTSD AND IDIOPATHIC NIGHTMARE PATIENTS WITH IMAGERY REHEARSAL

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ABSTRACT

Background: Imagery rehearsal, a cognitive-behavioral technique for alleviating nightmares, has been reported to be associated with subjective improvements in sleep quality. However, no independent replication of this effect has been reported and no improvements in sleep quality have demonstrated using polysomnography (PSG). This study addressed these limitations as well as investigated whether imagery rehearsal differentially affects PTSD and idiopathic nightmare patients. **Methods**: Twelve patients consulting for frequent nightmares were assessed. Six of these patients suffered from posttraumatic stress disorder and frequent nightmares (P-NM) and six suffered from idiopathic nightmare (I-NM). All completed home measures of bad dreams and nightmares (prospective) on daily logs, responded to questionnaire measures of psychological distress (Beck Depression Inventory, Beck Anxiety Inventory, Posttraumatic Symptom Scale, and Nightmare Distress Questionnaire), and underwent polysomnographic (PSG), prior to and 8.5 weeks following a single group treatment session of imagery rehearsal. Comparisons were made for both the dream logs, measures of psychological distress, and the PSG recordings. **Results:** Treatment resulted in significant reductions in the nightmare frequency ($p = 0.007$), bad dream frequency ($p = 0.03$), and anxiety scores ($p = 0.004$). Apart from an increased micro-arousal index, no changes in sleep structure were noteworthy. Post-treatment, only I-NM patients reported fewer nightmares retrospectively and fewer bad dreams prospectively. P-NM patients also reported fewer nightmares and fewer bad dreams, but these reductions were not statistically significant. I-NM patients also exhibited lower depression scores and marginally lower anxiety scores, whereas P-NM patients showed lower anxiety scores and reduced PTSD severity. I-NM patients showed an increase in %S2 and a reduction of periodic leg movements in REM sleep, whereas P-NM patients exhibited elevated micro-arousal indices and a marginal increase in REM density. **Conclusion**: The results independently replicate the efficacy of imagery rehearsal treatment for nightmares and other symptoms of psychological distress, but suggest that the effects may vary for idiopathic versus posttraumatic pathophysiologies. Nightmare alleviation appears to reduce periodic leg movements in REM sleep in idiopathic patients, whereas it may facilitate emotional processing during sleep in posttraumatic patients.

INTRODUCTION

The prevalence of disturbing dreams in patients suffering from posttraumatic stress disorder (PTSD) may be as high as 90% (Horowitz, Wilner, Kaltreider, & Alvarez, 1980; Kilpatrick et al., 1994; Riggs, Rothbaum, & Foa, 1995; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992), depending on the time of post-trauma assessment. In the general population, it is estimated that between 4% to 8% suffer from nightmares (Bixler, Kales, Soldatos, Kales & Healthy, 1979; Klink & Quan, 1987). However, these estimates do not take into account the possibility that individuals reporting nightmares may also suffer from PTSD. Considering that 5% of community samples present current PTSD (Kilpatrick et al., 1994), and that a conservative estimate of nightmare prevalence in PTSD approximates 75%, it is possible that 3.75% of the general population who could report PTSD-related nightmares. This leaves, at best, an estimated prevalence of 0.25% to 4.25% of the general population reporting non-PTSD or idiopathic nightmares.

Nevertheless, for both PTSD and idiopathic nightmare (I-NM) patients, sleep disturbances are common. Studies suggest that as many as 70- 90% of PTSD patients report sleep disturbances such as increased sleep onset latency (SOL), decreased total sleep time (TST), decreased sleep efficiency (SE; ratio between TST and total time spent in bed), lengthier wake time awake after sleep onset (WASO), more frequent nocturnal awakening, more body movements during sleep, and greater difficulty returning to sleep after awakening from a nightmare (Brown & Boudewyns, 1996; Glaubman, Mikulincer, Porat, Wasserman, & Birger, 1990; Hurwitz, Mahowald, Kuskowski, & Engdahl, 1998; Inman, Silver, & Doghramji, 1990; Krakow, Tandberg, Barey, & Scriggins, 1995b;

Krakow et al., 2000a; Mellman, David, Kulick-Bell, Hebding, & Nolan, 1995a; Mellman, Kulick-Bell, Ashlock, & Nolan, 1995b; Mellman, Kulick-Bell, Hebding, & Nolan,1995c; Neylan et al., 1998; Riggs et al. 1995; Rothbaum et al., 1992; van der Kolk, Blitz, Burr, Sherry, & Hartmann, 1984; Woodward, Arsenault, & Richardson, 1992; Woodward, Bliwise, Friedman, & Gusman, 1996). In I-NM patients, Hersen (1971) and Haynes & Mooney (1975) both found more sleep-related complaints than in control participants, including increased sleep latencies and increased number of nocturnal awakenings than in control participants. These findings were replicated by Cellucci & Lawrence (1978a) with student nightmare sufferers. Levin (1994) also reported that students with frequent nightmares could be distinguished from students with few nightmares on a number of sleep-related variables, including sleep quality and frequent nocturnal awakenings. Differences between acute (< six-month duration) and chronic (> six month-duration) idiopathic nightmare patients have been noted on measures of fear of going to sleep, repeated awakenings during sleep, difficulty returning to sleep following nocturnal awakenings, and fitful, restless sleep (Krakow, Tandberg, Scriggins, & Barey, 1995c). In this study, acute nightmare patients reported a greater fear of going to sleep than did chronic patients but a lower prevalence of nocturnal awakenings compared to chronic nightmare sufferers.

Cognitive-behavioral techniques such as desensitization (Burgess, Marks, & Gill, 1994; Cavior & Deutsch, 1975; Cellucci & Lawrence, 1978b; Geer & Silverman, 1967; Miller & DiPilato, 1983; Shorkley & Himle, 1974), hypnosis (Eichelman, 1985; Gorton, 1988; Kingsbury, 1993; Seif, 1985), lucid dreaming (Abramovitch, 1995; Brylowski, 1990; Zadra & Pihl, 1997), eye movement densensitization and reprocessing (EMDR; Marquis, 1991; Pellicer, 1993; Puk,

1991, Shapiro, 1989a, 1989b), and imagery rehearsal (Halliday, 1982; Kellner, Neidhardt, Krakow & Pathak, 1992; Krakow, Kellner, Neidhardt & Pathak, 1993; Krakow, Kellner, Pathak & Lambert, 1995a; Krakow et al., 2000b; Neidhardt, Krakow, Kellner & Pathak, 1992) have been found to markedly reduce nightmare frequency in both P-NM and I-NM patients within 6 to 12 weeks (Kellner et al., 1992; Neidardt et al., 1992; Krakow et al., 2000b). Moreover, these studies have shown that nightmare treatment also alleviates subjectively assessed sleep quality have been reported following nightmare alleviation. Reduced sleep latencies (Cellucci & Lawrence 1978b; Geer & Silverman, 1967; Seif, 1985), decreased duration of nocturnal awakenings (Cavior & Deutsch, 1975), alleviation of insomnia (Abramovitch, 1995; Seif, 1985; Shapiro, 1989a; Shorkey & Himle, 1974), and increased sleep quality (Eichelman, 1985; Halliday, 1982; Krakow et al., 1995a, Krakow et al, 2000b) have all been found following nightmare alleviation with cognitive-behavioral techniques. Similarly, nightmare alleviation is accompanied by significant reductions in psychological distress (Kellner et al., 1992; Krakow et al., 1995a; 2000c; Neidhardt et al., 1992). The efficacy of imagery rehearsal with both I-NM and P-NM patients has been demonstrated by one research group (Kellner et al., 1992; Krakow et al., 1995a, Krakow et al, 2000b; Neidhardt et al., 1992). However, these effects have not been independently replicated nor has the efficacy of imagery rehearsal or other cognitive-behavioral techniques, been assessed with prospective measures of nightmare frequency and objective measures of sleep quality.

PTSD-related nightmares (P-NM) and idiopathic nightmares (I-NM) are conceptualized as etiologically and phenomenologically distinct (Hartmann, 1996).

Etiologically, P-NM require the occurrence of a traumatic event preceding the onset of nightmares (APA, 1994), whereas I-NM start in childhood and persist into adulthood, and are not associated with a preceding trauma (Hartmann, 1984). Phenomenologically, PTSD nightmares can occur in all sleep stages (van der Kolk et al., 1984), whereas I-NM typically occur in the second half on the night, when REM sleep is more prominent (Kales et al., 1980; Hartmann, 1984).

In a previous study, we demonstrated that P-NM and I-NM patients both exhibit elevated indices of periodic leg movement in sleep (PLMS) and gross body movements compared to control subjects, but that only a greater frequency of nocturnal awakenings differentiated the P-NM patients from the I-NM patients and healthy control (CTL) subjects (Germain & Nielsen, submitted). We suggested that PLMS might be a correlate of intense negative dreaming, whereas an increased number of nocturnal awakenings may reflect the hyperarousal component specific to PTSD. Clinically, this would imply that alleviation of nightmares might be associated with a reduction of periodic leg movements in both nightmare groups. Furthermore, and following the suggestion that nightmares are a maintaining factor of sleep disruption in PTSD (Ross, Ball, Sullivan, & Caroff, 1989), a decrease in the number of nocturnal awakenings and reduced wake time after sleep onset would be expected following alleviation of PTSD-related nightmares.

The goals of the present study were thus to independently replicate the efficacy of imagery rehearsal for alleviating nightmares, and to investigate whether nightmare alleviation is associated with objectively measured sleep improvements in nightmare patients. Additionally, we examined the effects of

imagery rehearsal on P-NM and I-NM patients to explore whether these groups respond differentially to this form of treatment.

METHODS

Participants

Nightmare patients were recruited mainly from advertisements that appeared in the University of Montreal's campus newspaper and following a short televised documentary on the laboratory study of nightmares that was presented during prime time news. To enter the study, participants 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. Participants were excluded if 1) they were currently under medications known to influence sleep and dreams, 2) they were currently suffering from a major psychiatric disorder other than PTSD, 3) they reported currently suffering from another major sleep disorder (e.g. obstructive sleep apnea, narcolepsy), 4) they were diagnosed with a neurological disorder, 5) they reported using or abusing alcohol or drugs on a regular basis, 6) they reported irregular sleep-wake schedules or had undergone jet lag in the previous three months, or 7) they were currently engaged in legal procedures involving events related to their nightmares or trauma. Twelve nightmare patients met these criteria and participated in the study. Six suffered posttraumatic stress disorder (4 men and 2 women, M age = 41.5 $\pm$ 10.7 years) and six reported idiopathic nightmares (3 men and 3 women; M age = 27.2 $\pm$ 5.8 years). PTSD status was determined using the Posttraumatic Symptom Scale (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993) and the Clinician's Assessment of Posttraumatic Stress (CAPS;

Blake et al., 1993). Table 1 presents information on participants' age, gender, NM chronicity, and PTSD severity and chronicity (when applicable). Three of the idiopathic nightmare patients also reported having experienced traumatic events but in all cases the onset of nightmares was determined to precede the trauma, and none met the criteria for past or current PTSD. Half of the P-NM patients met the criteria for current depressive episode in the severe range. One I-NM patient (patient 1) and none of the P-NM patients reported a prior history of substance abuse. The Sacre-Coeur Hospital Ethics Committee approved the study. Written and oral consent was obtained from all participants.

Insert Table 1 about here

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, 1988a), and the Nightmare Distress Questionnaire (NDQ; Belicki, 1992a). 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 et al., 1988a; Beck, Steer, & Garbin, 1988b). 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 (Belicki, 1992a, 1992b). This instrument has been shown to be reliable; high scores are significantly correlated with interests in pursuing therapy for nightmares (Belicki, 1992a, 1992b). Finally, patients who reported that the onset of their nightmares followed a traumatic experience completed the Posttraumatic Symptom Scale (PSS; Foa et al., 1993), which measures PTSD symptoms according to DSM-III-R criteria (APA, 1987), and evaluates the severity of intrusion, avoidance and arousal symptoms in the preceding two week period (Foa et al., 1993). On all four measures, higher scores reflect greater symptom severity.

Prospective Home Dream Logs

A retrospective estimate of nightmare frequency (nightmares per week for the previous month) was obtained for all participants at intake, and again just prior to the post-treatment sleep evaluation. Further, for the 15 days prior to sleeping in the laboratory, all subjects completed a daily home dream log in which they indicated whether they had had a nightmare (an unpleasant dream that awakened them), a bad dream (an unpleasant dream that did not immediately awaken them), or a sleep terror (a sudden awakening accompanied by intense feelings of panic and minimal dream content recall). All three events were described to participants when they received the dream log, with written definitions also provided in the logs. The same log was completed again for 15 nights preceding the post-treatment laboratory sleep recording. 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. This permitted comparison with the retrospective nightmare estimates.

Polysomnography

All participants slept in the laboratory for polysomnographic recordings (PSG) for two consecutive nights on two different occasions. PSG1 was conducted prior to treatment and PSG2 was conducted six to 14 weeks after the nightmare treatment session (M = 8.5 weeks, *SD* = 3.4). Each PSG was performed with a 32-channel montage measuring EEG with the International 10-20 system of electrode placements (FP1, FP2, F3, F4, F7, F8, C3, C4, T3, T4, T5, T6, P3, P4, O1, O2, Fz, Cz, Pz), eye movements (LOC-A2; ROC-A1), EMG (submental and right tibialis), oral-nasal airflow, 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 polysomnographic 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. Sleep onset latency (SOL) was computed as the interval between lights out and the first episode of sleep. PLMS were scored according to Coleman's criteria (1982). REM density was computed as the absolute number of REMs for the last five minutes of each REM sleep episode; an average REM density per minute for the first four REM periods was calculated (Tachibana, Sugita, Terashima, Teshima, Shimiza, & Hishikawa, 1992). Micro-arousals were defined as abrupt changes in EEG frequency, which may include

alpha or theta frequencies but not spindles, with a minimal duration of 3 seconds, a maximal duration of 10 seconds, and a minimal interval of continuous sleep of 10 seconds (American Sleep Disorders Association, 1992). The first night was an adaptation night and only results collected from the second night were assessed. Bedtime was between 22:00 and midnight depending on the participant's usual bedtime, and the morning awakening was conducted between 06:00 and 08:00, again, depending on the participant's typical schedule. In the morning, electrodes were removed and participants were free to go for the day. Prior to leaving the laboratory after PSG1, they were reminded to avoid caffeine consumption and naps during that day. All participants received a monetary compensation of 20$ per night slept in the laboratory.

Nightmare Treatment Session

Participants underwent one imagery rehearsal treatment session conducted in a small group format (N = 2 to 5, combining PTSD and I-NM patients) that was scheduled within two weeks of PSG1. This three-hour session consisted of two parts. In the first part, participants were given information regarding the prevalence of nightmare complaints and the possible causes of nightmares and were encouraged to ask questions about nightmares. In the second part, the rationale for imagery rehearsal was presented and the technique was introduced and practiced once in the group. Specifically, participants 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 five-minute 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 the new dream at home, at least once a day, every day, for the next 4-6 weeks.

Statistical Analyses

Statistica 5.1 software (StatSoft, 1996) was used. Logarithmic and square root transformations were applied to PSG measures prior to conducting statistical analyses. Assumptions of homogeneity of variance and distribution normality were then respected for all variables, and Student's t tests for paired samples were used to perform pre/post-treatment comparisons.

RESULTS

Impact of imagery rehearsal on disturbing dream events

Results for efficacy of the imagery rehearsal treatment are shown in Table 2. The retrospective nightmare frequency estimate ($t_{(11)} = 3.33$, $p = 0.007$) and the prospective bad dream frequency estimate ($t_{(11)} = 2.69$, $p = 0.03$) were significantly reduced by treatment. However, prospective measures of nightmare and sleep terror frequency remained unchanged. Although both subgroups retrospectively reported a 50% or more reduction in nightmare frequency, this

reduction was significant only for I-NM patients ($t_{(5)}$= 3.14, p = 0.03) (Table 2). Similarly, the marked reduction in frequency of bad dreams post-treatment was significant only for I-NM patients ($t_{(5)}$ = 6.87, p = 0.02). All but one P-NM patient reported fewer nightmares post-treatment, and the remaining patient (P-NM patient 6) reported more nightmares post-treatment. Five I-NM patients reported fewer nightmares, and one (I-NM patient 1) reported no change in nightmare frequency post-treatment.

Insert Table 2 about here

Impact of imagery rehearsal measures on subjective distress

Prior to treatment, P-NM patients tended to show higher depression scores than did I-NM patients ($t_{(11)}$ = 2.19, p = 0.06). The two groups did not differ on the anxiety or distress due to nightmares. In parallel to the observed decreases in nightmare and bad dream frequency, symptoms of anxiety ($t_{(11)}$= 3.64, p = 0.004) and nightmare distress ($t_{(11)}$ = 2.57, p = 0.03) were significantly reduced post-treatment (Table 3). A marginal reduction of depressive symptoms was also observed ($t_{(11)}$ = 2.12, p = 0.06). Also, similar to the observed changes in nightmare measures, different changes in psychological distress measures were noted for the two subgroups. P-NM patients showed significant reductions in anxiety symptoms ($t_{(5)}$ = 3.35, p = 0.02) and PTSD severity ($t_{(5)}$ = 3.16, p = 0.02). I-NM patients showed reductions in depression ($t_{(5)}$ = 3.28, p = 0.02) and in anxiety ($t_{(11)}$ = 2.15, p = 0.10).

Insert Table 3 about here

Impact of imagery rehearsal on sleep measures

Few sleep measures were changed as a function of imagery rehearsal (Table 4). Post-treatment, the number of micro-arousals increased significantly ($t_{(11)}$= - 2.27, p = 0.04), and %S4 was marginally reduced ($t_{(11)}$= 2.13, p = 0.06). However, the profiles of changes were again different for I-NM and P-NM patients. For I-NM patients, the PLM index in REM sleep decreased ($t_{(5)}$ = 3.1, p = 0.04), and %S2 also decreased ($t_{(5)}$ = -2.61, p = 0.05). However, although PLM were scored according to Coleman's and the ASDA criteria (1982; 1992), post-hoc inspection of inter-movement intervals suggested that these movements were gross body movements rather than PLMS per se. For P-NM patients, the micro-arousal index increased ($t_{(5)}$ = - 4.02, p = 0.01) and REM density marginally increased ($t_{(5)}$ = - 2.43, p = 0.06).

Insert Table 4 about here

DISCUSSION

Our findings for the retrospective measure of nightmare frequency independently replicates the finding that imagery rehearsal alleviates disturbing dreams in nightmare patients, since previous studies have exclusively used retrospective measures of nightmare frequency in demonstrating therapeutic success (e.g., Kellner et al., 1992; Krakow et al., 1995a; Krakow et al., 2000b). However, our prospective measures reveal that it is bad dreams, not necessarily nightmares (i.e., bad dreams with awakening), that account for this treatment effect. The daily recording of bad dreams appears to be a more valid measure of disturbed dreaming than are either retrospective or prospective measures of nightmare frequency.

Several factors support this contention. First, retrospective measures of nightmare frequency may largely confound experiences of nightmares and bad dreams. Since the only difference between the two experiences is the awakening component, patients may be poor at remembering or quantifying awakenings from sleep, and their memory for awakenings may be distorted. This is supported by a recent study demonstrating that bad dreams are more than 2.5 times as frequent as nightmares, yet their affective intensity is rated as being equal to that of nightmares (Zadra & Donderi, 2000). Further, imagery rehearsal may change some distressing aspects of nightmares, i.e., their affective intensity or quality, without altering the awakening component. This is supported by our observed reduction in both bad dreams and psychological distress (i.e. anxiety, nightmare distress, depression) that we observed on the one hand, but the lack of reduction in a) nightmares (prospectively measured) -- which directly reflect the awakening

component, and b) PSG-based measures of awakenings (e.g., number of awakenings, WASO). The point is further supported by studies showing that nightmare awakenings are not related to psychological distress (Kellner et al., 1992; Neidhardt et al., 1992). In fact, one study found that only 25% of frequent nightmare sufferers report always waking up after an intense and unpleasant dream (Krakow et al., 1995c), suggesting that awakenings from unpleasant dreams mayin fact, be rather infrequent.

Taken together, these considerations suggest that 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", which focuses on awakenings rather than the affective component of disturbing dreams may unnecessarily limit the construct of disturbing dreams, and may lead to an under-evaluation of the psychological components of the pathology. These considerations further support our contention that prospective logging of bad dreams is a superior method of measuring disturbing dreams, and bolsters recent calls for revisions of the DSM-IV (APA, 1994) Nightmare Disorder diagnostic criteria (Nielsen, Laberge, Paquet, Tremblay, Vitaro, & Montplaisir, 2000; Nielsen & Zadra, 2000; Zadra & Donderi, 2000).

While both groups achieved some degree of relief from psychological distress, the nature of this relief was slightly different for the two groups. P-NM patients appeared to benefit primarily from anxiety reduction as indicated by significantly reduced scores on the BAI, NDQ, and PSS scales. However, this relief was not reflected in a significant reduction of nightmares and bad dreams. I-NM patients primarily benefited from a reduction of nightmares (retrospectively

measured) and bad dreams (prospectively measured), whereas secondary benefits were observed in slight reductions in depression. Similarly, the few changes in sleep structure that were observed post-treatment indicated different types of responses by the two groups. P-NM patients had an increase in both micro-arousals and REM density; I-NM patients demonstrated an increase in %S2 and a decrease in REM-related PLMS.

Although these different response profiles may be explained in a number of ways, we suggest that they are due primarily to the different roles that affective processes play in the aetiology of the two disorders.

In the case of I-NM patients, we propose that imagery rehearsal decreases the affective intensity or quality of disturbing dreams. This is reflected primarily in a decrease in bad dreams, and secondarily in the reduction of psychological distress. Specifically, I-NM patients appear to benefit primarily from the alleviation of bad dreams, whereas secondary benefits are consistent with an easing of initially low levels of disturbed affect (fewer bad dreams and lower depression scores). The decrease in REM-related PLMS may also reflect this process. PLMS indices in REM sleep were in the mild range. Further examination of inter-movement intervals suggested that gross body movements may be a better physiological correlate of intense negative dreaming in I-NM patients. Body movements have been found to be associated with features of dream content such as heightened motor activity in both healthy subjects (Grossman, Gardner, & Roffwarg, 1973; Schwartz, Weinstein, & Arkin, 1978) and RBD patients (Mahowald & Schenck, 2000; Schenck, Hurwitz, & Mahowald, 1988). Thus, a reduction in PLMS in REM sleep may parallel a reduction in the affective intensity

or quality of disturbing dreams. One study previously reported increased phasic leg activity in REM sleep in PTSD patients (Ross et al., 1994) and suggested that abnormal motor activation related to phasic leg activity may be interpreted cortically as nightmares. However, the finding that I-NM patients exhibit lower PLMS in REM sleep post-treatment indicates that if such abnormal motor activation patterns exist, they are not exclusive to either PTSD or RBD.

The observed increase in %S2 post-treatment was not accompanied by any other indications of poorer sleep (e.g., decreased TST or SE, increased number of awakenings) in the laboratory environment. Its significance remain unknown.

In the case of P-NM patients, we propose that the observed changes reflect an activation of emotional processing in REM sleep instigated by treatment. This is indicated by the large reductions on measures of psychological distress, especially on the PSS scale. Our observed increases in both micro-arousals and REM density may reflect increases in emotional processing during sleep. Increased REM density has been reported to be a potential marker of emotional processing of disturbing waking life events during sleep in depressed patients (Cartwright, 1983). Micro-arousals too may reflect this process because emotional processing during wakefulness in PTSD is associated with measurable increases in arousal (e.g., Casada, Amdur, Larsen, & Liberzon, 1998; Blomhoff, Reinvang, & Malt, 1998). Thus, if indeed increased REM density post-treatment reflects emotional processing during sleep in PTSD patients, arousal in sleep would also be expected, despite the fact that the increased micro-arousal index observed in P-MN patients remained within normal ranges (Boselli, Parrino, Smerieri, & Terzano, 1998). Nevertheless, this may remain clinically significant

and may explain the present finding regarding the post-treatment increase in the micro-arousal index. P-NM patients appear to benefit more from reduction of waking psychological distress than they do from reductions in nightmares. This is more apparent in the fact that P-NM patients scored nightmare distress are being reduced, whereas their nightmare frequency only changed slightly.

In sum, we suggest that I-NM patients benefit primarily from the reduction in bad dreams and secondarily from mild reduction in psychological distress. In contrast, P-NM patients benefit primarily from the alleviation of anxiety possibly through a process of mastery, and only secondarily from a reduction in disturbed dreaming. One study has demonstrated that imagery rehearsal is associated with an increase in the sense of mastery over disturbing dream content in sexual assault survivors with PTSD (Germain, Krakow, Faucher, Zadra, & Nielsen, 2000). Thus, it is possible that an increase in the sense of mastery constitutes this more general process.

Summary

Other treatment studies that have included both I-NM and P-NM patients (Kellner et al., 1992; Neidhardt et al., 1992; Krakow et al., 2000) have reported significant reductions in retrospective reports of nightmare frequency within 6-12 weeks post-treatment, which corresponds to the post-treatment assessment delay used in the present study. None of the previous studies, however, has used prospective dream logs to assess reduction in nightmare frequency separately in these two groups of patients, nor have they ensured that patients understand the distinct definitions of nightmares and bad dreams.

This study independently replicates the efficacy of imagery rehearsal for alleviating idiopathic nightmares using retrospective measures of nightmare frequency and objective measures of sleep both pre- and post-treatment. However, the use of home logs indicates that bad dreams, rather than nightmares, are a more sensitive measure of disturbed dreaming. This observation further supports the distinction between nightmares and bad dreams (Halliday, 1991; Zadra & Donderi, 2000), and suggests that the current DSM-IV operational definition of nightmares, which emphasizes the behavioral (i.e., awakening) component requires refinement. Overall, our nightmare patients did not show objectively measurable improvements in sleep post-treatment as might have been expected from studies using retrospective measures of sleep quality (e.g. Krakow et al., 2000).

Although the small size of our sample limits interpretation of the findings regarding the impact of imagery rehearsal on sleep measures in subgroups of nightmare patients, the observations do offer preliminary support for the contention that idiopathic nightmares and PTSD-related nightmares are distinct pathologies that respond differentially to this form of treatment. In P-NM, imagery rehearsal appears to facilitate emotional processing indirectly by alleviating waking distress. In I-NM patients, the treatment appears to alleviate bad dreams more directly. Replications of the present study with larger samples are clearly needed to further clarify the relationships between nightmares of distinct aetiologies, waking psychological distress, and sleep processes. Another limiting factor in the present study is the lack of wait-list control groups. However, other studies have included wait-list control groups consisting of nightmare patients and

have shown that the passage of time alone is not sufficient to induce clinically significant reductions in NM frequency and improvements in sleep quality (Kellner et al, 1993; Krakow et al., 2000). Repeated post-treatment assessments would be valuable in determining the nature of sleep improvements following nightmare alleviation by imagery rehearsal treatment.

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Table 1. Descriptive information on PTSD nightmare (P-NM) and idiopathic nightmare (I-NM) patients in this study.

	Sex	Age [1]	NM Chronicity [2]	Reported Trauma	PTSD Severity	PTSD Chronicity (years)
P-NM						
1	M	28	3	Car crash	Severe	3
2	F	46	4	Rape	Severe	4
3	F	58	53	Sexual abuse [3]	Severe	14
4	M	35	25	Physical abuse [3]	Moderate	25
5	M	46	20	Parachute accident	Moderate	20
6	M	36	2.5	Physical assault	Severe	2
I-NM						
1	F	36	30	Kidnapped [3]	None	
2	M	19	13			
3	M	24	19	Armed robbery	None	
4	F	25	13			
5	M	29	24			
6	F	31	2			

[1] I-NM patients were significantly younger than P-NM patients ($F_{1,11} = 9.92$, $p = 0.009$)

[2] Nightmare chronicity did not differ between the two nightmare groups.

[3] Trauma occurred in childhood.

Table 2. Mean number of nightmares (NM) reported retrospectively, and mean numbers of NMs, bad dreams (BD), and sleep terrors (ST; standard deviations in parentheses) recalled per week in the 15-night prospective dream logs for the two subgroups of nightmare patients, pre- and post- treatment with imagery rehearsal.

	All NM (N = 12)			P-NM (N = 6)			I-NM (N= 6)		
	Pre	**Post**	**t-test‡**	**Pre**	**Post**	**t-test†**	**Pre**	**Post**	**t-test†**
Retrospective NM/week	3.0 (1.7)	1.3 (1.5)	3.33 p = 0.007	3.0 (2.1)	1.5 (1.6)	1.71 ns	3.2 (1.4)	1.1 (1.5)	3.14 p = 0.03
Prospective NM/ week	3.2 (3.2)	3.6 (4.3)	- 1.55 ns	2.4 (1.0)	3.3 (2.5)	- 0.68 ns	3.3 (4.2)	3.4 (6.0)	- 0.88 ns
Prospective BD/ week	6.4 (6.3)	3.7 (3.5)	2.69 p = 0.03	9.5 (7.7)	4.6 (3.6)	2.23 ns	3.7 (2.3)	3.2 (3.3)	6.87 p = 0.02
Prospective ST/ week	0.5 (0.9)	0.0 (0.0)	1.73 ns	0.4 (0.6)	0.0 (0.0)	1.34 ns	0.5 (1.1)	0.0 (0.0)	1.00 ns

‡ all df = 11

† all df = 5

Table 3. Mean scores (standard deviations in parentheses) on measures of anxiety, depression, nightmare distress and posttraumatic symptom severity (when applicable).

	All NM (N = 12)			P-NM (N = 6)			I-NM (N= 6)		
	Pre	Post	t ‡	Pre	Post	t†	Pre	Post	t†
Anxiety	15.1 (10.0)	6.8 (6.0)	3.64 (p = 0.004)	16.8 (6.6)	7.8 (6.9)	3.35 (p = 0.02)	16.0 (2.5)	6.6 (5.5)	2.15 (p = 0.10)
Depression	15.5 (8.7)	8.8 (8.2)	2.12 (p = 0.06)	20.2 (8.6)	13.3 (9.2)	1.08 (ns)	11.8 (6.5)	4.2 (4.3)	3.77 (p = 0.02)
Nightmare Distress	38.7 (7.1)	28.9 (13.7)	2.57 (p= 0.03)	40.0 (7.0)	30.7 (16.3)	1.84 (ns)	39.0 (7.0)	26.6 (13.1)	0.45 (ns)
PSS	NA	NA	NA	35.0 (8.4)	16.7 (12.39)	3.16 (p = 0.02)	NA	NA	NA

‡ all df = 11

† all df = 5

Table 4. Mean (SD) PSG scores for all nightmare patients (All NM), and for the two subgroups of nightmare patients.

	All NM (N = 12)			P-NM (N = 6)			I-NM (N= 6)		
	Pre	**Post**	**t-test ‡**	**Pre**	**Post**	**t-test †**	**Pre**	**Post**	**t-test †**
SOL*	17.3	15.5	0.16	10.8	15.1	- 0.60	20.8	16.0	0.95
	(17.5)	(15.3)		(9.6)	(16.9)		(23.0)	(16.9)	
TST	355.7	372.5	- 0.93	362.5	370.0	- 0.22	295.6	375.0	- 1.72
	(39.5)	(40.0)		(50.9)	(40.2)		(128.7)	(43.5)	
WASO*	56.7	62.2	- 0.29	80.9	81.3	- 0.18	32.5	43.1	- 0.53
	(56.0)	(62.3)		(72.4)	(76.6)		(16.4)	(42.5)	
Number of* Awakenings	34.4	38.1	- 0.61	46.7	50.8	- 0.14	22.2	25.3	- 1.01
	(21.5)	(27.8)		(22.9)	(34.2)		(11.4)	(11.9)	
Sleep Efficiency**	87.3	86.1	0.43	83.0	82.0	0.67	91.6	90.2	0.05
	(10.5)	(11.1)		(13.5)	(12.3)		(4.02)	(8.8)	

‡ all df = 11

† all df = 5

* Square root transformation performed before analyses. Mean values are presented in original units.

** Log transformation Ln (100- n-1) performed before analyses. Mean values are presented in original units.

*** Log transformation Ln (var) performed before analyses. Mean values are presented in original units.

Table 4. Mean (SD) PSG scores for all nightmare patients (All NM), and for the two subgroups of nightmare patients (continued).

	All NM (N = 12)			P-NM (N = 6)			I-NM (N= 6)		
	Pre	Post	t-test‡	Pre	Post	t-test†	Pre	Post	t-test†
Micro-arousal index*	8.2 (4.8)	9.8 (5.7)	- 2.27 (p = 0.04)	9.8 (5.7)	12.6 (6.11)	- 4.02 (p = 0.01)	6.7 (3.7)	7.0 (4.0)	- 0.31
REM Latency*	84.5 (27.1)	85.7 (32.4)	0.03	80.72 (14.4)	70.88 (33.6)	0.92	88.3 (37.2)	100.5 (52.5)	- 0.59
REM Density*	6.4 (6.8)	7.0 (4.6)	- 0.65	6.6 (5.4)	8.8 (5.1)	- 2.43 (p = 0.06)	6.1 (8.6)	5.0 (3.1)	0.14
Global PLMI*	4.6 (3.5)	4.5 (2.4)	- 0.27	5.3 (4.3)	4.7 (1.9)	0.19	3.7 (2.2)	4.2 (3.0)	- 0.17
REM PLMI*	13.4 (11.4)	11.8 (7.4)	0.25	12.1 (6.8)	12.4 (5.9)	- 2.04	14.9 (16.1)	11.3 (9.2)	3.10 (p = 0.04)
NREM PLMI*	2.7 (3.4)	2.5 (2.0)	- 0.51	4.0 (4.2)	3.1 (2.3)	0.04	1.1 (1.0)	2.1 (1.7)	- 0.82

‡ all df = 11

† all df = 5

* Square root transformation performed before analyses. Mean values are presented in original units.

** Log transformation Ln (100- n-1) performed before analyses. Mean values are presented in original units.

*** Log transformation Ln (var) performed before analyses. Mean values are presented in original units.

Table 4. Mean (SD) PSG scores for all nightmare patients (All NM), and for the two subgroups of nightmare patients (continued).

	All NM (N = 12)			P-NM (N = 6)			I-NM (N= 6)		
	Pre	Post	t-test‡	Pre	Post	t-test†	Pre	Post	t-test†
% S1* **	10.6 (4.8)	10.9 (5.8)	- 0.12	13.4 (5.2)	13.9 (5.5)	- 0.72	7.7 (2.3)	8.0 (4.6)	- 0.13
% S2* **	62.0 (7.1)	63.5 (7.7)	- 0.79	65.0 (5.0)	64.6 (7.5)	0.13	59.0 (7.9)	62.5 (8.3)	- 2.61 (p = 0.05)
% S3* **	7.32 (5.6)	5.2 (4.0)	1.03	4.4 (4.4)	3.3 (2.6)	0.05	10.2 (5.4)	7.1 (4.4)	1.86
% S4* **	1.5 (2.6)	1.2 (2.7)	2.13 (p = 0.06)	0.3 (0.4)	0.2 (0.4)	1.15	2.7 (3.4)	2.3 (3.6)	1.86
% REM	18.6 (3.9)	19.1 (7.34)	- 0.26	16.9 (1.9)	20.3 (4.8)	- 0.29	18.1 (9.0)	20.2 (5.9)	- 0.14

‡ all df = 11

† all df = 5

* Square root transformation performed before analyses. Mean values are presented in original units.

** Log transformation Ln (100- n-1) performed before analyses. Mean values are presented in original units.

*** Log transformation Ln (var) performed before analyses. Mean values are presented in original units.

IV. GENERAL DISCUSSION

In the Introduction, a literature review of the empirical evidence for sleep disturbances in PTSD demonstrated that contemporary sleep-related hypotheses of PTSD patients are only partially supported by empirical findings. In particular, there is mixed support for the claims that 1) intensification of REM is a correlate of attempts to assimilate the trauma, and 2) REM sleep dysfunction is the primary disturbance in PTSD. Some studies also found NREM sleep disturbances in PTSD, whereas others reported a complete absence of sleep disturbances. An alternative nightmare-specific explanation was thus suggested. This explanation stipulates that the sleep pathology in PTSD may be related to the frequent experience of nightmares (i.e. disturbing dreams that awaken the sleeper). Specifically, both the disturbing affective nature of nightmares and their awakening component may be involved in the occurrence of sleep disturbances in nightmare patients with or without PTSD. It was therefore hypothesized that P-NM and I-NM patients would demonstrate more sleep anomalies than healthy control (CTL) participants. The sleep profiles of P-NM and I-NM, however, was not expected to differ (Hypothesis 1).

The proposed nightmare-specific explanation of sleep disturbances in nightmare patients with or without PTSD also implied that nightmare alleviation may be accompanied by marked reductions in nightmare frequency and waking psychological distress (Hypothesis 2), and by quantifiable improvements in sleep (Hypothesis 3).

1. Summary of findings

Hypothesis 1 was partially confirmed. Specifically, both I-NM and P-NM patients demonstrated more PLMS than CTL participants in both REM and NREM sleep. Examination of the PLMS inter-movement intervals, however, suggested that gross body movements, as well as PLMS, may be more frequent in P-NM and I-NM patients. This provides preliminary support that sleep anomalies in P-NM and I-NM patients may arise from a common nightmare-related mechanism. We thus proposed that PLMS and gross body movements ~~may~~might be correlates of intense negative dreaming in both groups of nightmare patients.

However, the number of nocturnal awakenings was significantly greater in P-NM patients than in both I-NM patients and CTL participants. This finding suggests that nocturnal awakenings may be a correlate of a PTSD-specific sleep dysfunction associated with the more general hyperarousal component of PTSD, rather than attributable to a specific underlying nightmare-related awakening pathophysiology.

In fact, contrary to Hypothesis 1, few sleep measures were found to distinguish P-NM and I-NM patients from CTL participants. This suggests that frequent nightmares may be a correlate of psychological distress that has a minimal direct pathological action on sleep. Specifically, nightmares may be a correlate of waking psychological distress, rather than a marker of a quantifiable sleep anomaly. However, it remains possible that nightmare patients sleep better in the laboratory environment (as they often report), and that the absence of

gross sleep disturbances (except for PLMS) is, in part, due to the fact that they rarely have nightmares in the sleep laboratory.

Hypothesis 2 was confirmed in the independent replication of the efficacy of imagery rehearsal for alleviating disturbing dreams. Specifically, nightmare patients retrospectively reported fewer nightmares, fewer anxiety symptoms, less nightmare distress, and marginally fewer depression symptoms post-treatment.

The finding of a reduction in nightmares (retrospective measure) is consistent with previous studies that have traditionally used retrospective measures of nightmare frequency. However, prospective measures showed that bad dreams (disturbing dreams not associated with immediate awakenings), but not nightmares (disturbing dreams that awaken the sleeper), were significantly alleviated post-treatment. Bad dreams appear to be a more valid and sensitive measure of dream disturbances. Consistent with previous suggestions, this observation indicates that the current DSM-IV operational definition of nightmares may require refinements.

P-NM and I-NM patients appear to respond differently to imagery rehearsal. P-NM patients demonstrated no significant reductions in nightmares or bad dreams post-treatment, but endorsed significantly fewer anxiety symptoms (i.e., anxiety, nightmare distress, posttraumatic symptom severity) post-treatment. I-NM patients reported significantly fewer nightmares and bad dreams post-treatment, fewer depression symptoms, and marginally fewer anxiety symptoms post-treatment. Although the small sample sizes limit the generalizability of the results, these findings suggest that 1) posttraumatic and idiopathic nightmares

represent distinct pathologies, and 2) treatment affects these pathologies differentially. Specifically, P-NM patients appear to benefit primarily from waking anxiety reduction, and this may precede later changes in the frequency of disturbing dreams. Longer follow-up assessments are required to investigate this possibility. I-NM patients appear to benefit primarily from alleviation of disturbing dreams, and secondarily, from slight reductions in depression and anxiety.

Hypothesis 3 was not clearly supported by the treatment study; quantifiable improvements in sleep quality were not observed post-treatment. Rather, overall the micro-arousal index was increased and %S4 was marginally reduced post-treatment. The micro-arousal index, however, remained within reported normal ranges (Boselli, Parrino, Smerieri, & Terzano, 1998). Although it is possible that nightmare patients were habituated to the laboratory environment post-treatment (and thus, that their sleep at PSG2 resembled more closely their usual home sleep compared to their sleep at PSG1), the different sleep profiles of P-NM and I-NM indicate alternative explanations.

The I-NM patient group alone demonstrated slightly more %S2 sleep and fewer PLMS in REM sleep post-treatment. Neither measure, however, suggests either an improvement or a worsening of sleep; the changes were not accompanied by any other, more conclusive indicators of poorer or better sleep quality such as concomitant changes in SE or WASO. Rather, the finding that PLMS in REM sleep were reduced post-treatment is consistent with the initial claim that PLMS may be a correlate of intense negative dreaming. Examination of the inter-movement intervals, however, suggest that both PLMS and gross body movements in REM sleep are affected and might be markers of intensified

processes in this subgroup of nightmare patients. Post-treatment, the P-NM patient group demonstrated an elevated micro-arousal index and a marginal increase in REM density. I have thus suggested that both measures may reflect a facilitation of emotional processing during sleep in PTSD patients post-treatment, as indicated by the finding that P-NM patients primarily benefited from a reduction of waking anxiety symptoms, especially PTSD symptoms post-treatment.

2. Revision of the alternative explanation for sleep disturbances in PTSD

Initially, I proposed that sleep disturbances in PTSD patients might be explained by the frequent experience of nightmares. I therefore hypothesized that both P-NM and I-NM patients would demonstrate more sleep anomalies than CTL participants. Findings from Study 1 partially supported the proposed explanation. Specifically, both P-NM and I-NM patients demonstrated increased PLMS indices compared to CTL participants, but P-NM patients also demonstrated more nocturnal awakenings that I-NM patients and CTL subjects. Therefore, these results indicated that sleep disturbances in PTSD may arise from both the recurrent experience of disturbing dreams and hyperarousal processes inherent to PTSD, rather than arising only from the experience of frequent nightmares as I initially hypothesized. This, in turn, might be a preliminary indication that the mechanisms underlying nightmares in the two pathologies are similar for abnormal affective oneiric processes, but dissimilar for the awakening component of nightmares.

The treatment study provides preliminary support for this suggestion. More precisely, I-NM patients appear to benefit primarily from alleviation of bad dreams,

The treatment study provides preliminary support for this suggestion. More precisely, I-NM patients appear to benefit primarily from alleviation of bad dreams, which is associated with a significant reduction of PLMS (and/or gross body movements) in REM sleep. The primary effect of imagery rehearsal in I-NM patients thus, appears to be related to the alleviation of disturbing oneiric processes and their possible behavioural correlates (i.e., PLMS). However, markers and alterations of the awakening component (e.g., increased number of nocturnal awakenings, WASO) were not observed in I-NM patients. Alternatively, P-NM patients showed more indications of the proposed awakening mechanism (e.g., increased number of awakenings, increased micro-arousal index), and appeared to benefit primarily from a reduction of waking anxiety (especially PTSD symptoms). Taking these considerations together, I suggested that disturbing dreams in PTSD may be correlates of waking psychological distress related to the hyperarousal component of PTSD, rather than independent markers of the nightmare pathology associated with abnormal affective oneiric processes and sleep anomalies.

Few sleep differences were initially observed between both subgroups of nightmare patients and healthy participants. This general absence of gross sleep anomalies in both P-NM and I-NM may indicate that the affective component of chronic nightmares (anxiety, nightmare distress) may not be directly producing awakenings and sleep disruption. Findings from the second study support for this; nightmare alleviation paralleled reductions in psychological distress, in spite of the lack of quantifiable sleep improvements in both groups.

In sum, the initial alternative explanation for sleep disturbances in PTSD was not completely supported, and findings from the two studies suggested a more restricted version of it. For P-NM patients, the awakening component of nightmares is prominent and related to sleep disruption compared to both I-NM patients and healthy participants, and may be a sleep-related correlate of the waking hyperarousal component of PTSD. Alternatively, the affective component of nightmares in PTSD patients and their possible behavioural correlates (i.e., PLMS and/or gross body movements) might be secondarily related to waking psychological distress. For I-NM patients, disturbed affective oneiric processes and PLMS and/or gross body movements, rather than an abnormal nightmare-related awakening mechanism, may constitute the primary sleep dysfunction.

3. Methodological considerations

The two studies presented in this dissertation share certain limitations. Although the inclusion of a group of PTSD patients not reporting nightmares would have contributed considerably to clarifying the relationship between nightmares, sleep disturbances, and PTSD, the possibility of recruiting non-medicated PTSD patients reporting no nightmares, no history of substance or alcohol abuse, and who would be interested in participating in a research protocol seems slim. All of the previous studies investigating sleep disturbances in PTSD patients have been conducted with psychiatric inpatients or outpatients, and most have recruited their participants from the American Veteran Administration system and related organizations. Thus, idiopathic nightmare patients were the most suitable nightmare control group available.

The small sample sizes are closely linked to the stringent inclusion and exclusion criteria established in the research protocol. Replication with larger samples may help determine the impact of disturbing dreams and their behavioural ramifications during sleep. Larger samples would also allow investigations of whether specific types of disturbing dreams are related to different profiles of disrupted sleep in both I-NM and P-NM patients.

The lack of both wait-list control groups and later follow-up assessments of the psychological and behavioural impact of treatment is another limitation of Study 2. However, other studies have included wait-list control groups composed of nightmare patients and have shown that the mere passage of time was not sufficient to induce clinically significant reductions in nightmare frequency and improvements in sleep quality (Kellner et al, 1993; Krakow et al., 2000). Furthermore, few additional gains have been reported at follow-up assessments over three months post-treatment (Krakow et al., 1993).

4. Original contributions

This dissertation encompasses several innovative and original contributions. First, it is the first study to investigate the sleep characteristics of PTSD patients reporting frequent nightmares and to contrast them with idiopathic nightmare patients both pre-and post-treatment using polysomnographic recordings. Second, the inclusion of I-NM patients as a comparison group provides new empirical sleep findings for this rarely-studied group. Third, Study 2 is the first independent replication of the efficacy of imagery rehearsal treatment

for alleviating nightmares. Fourth, the use of prospective measures of both nightmares and bad dreams to determine the efficacy of imagery rehearsal sheds new light on the problem of defining and measuring nightmares. Fifth, this study is the first to provide evidence (albeit preliminary) for the differential effects of imagery rehearsal on posttraumatic and idiopathic nightmares and other measures of psychological distress.

In sum, this dissertation project permitted empirical exploration of a new nightmare-specific explanation for the sleep disturbances previously reported in nightmare patients, with and without PTSD. The findings provide clarifications on the relationships between nightmares, sleep disturbances, and waking distress in two groups of nightmare patients. Further investigations of the interactions between abnormal oneiric processes and sleep microstructure may elucidate the neuropsychological substrates of idiopathic and posttraumatic nightmares.

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Appendices

Appendix A

Diagnostic criteria for Posttraumatic Stress Disorder

Diagnostic criteria for Posttraumatic Stress Disorder according to the fourth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 1994) [a].

A. The person has to be exposed to a traumatic event in which both of the following were present:

(1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of the self or others;
(2) the person's response involved intense fear, helplessness, or horror.

B. The traumatic event is persistently re-experienced in one or more of the following ways:

(1) recurrent and intrusive distressing recollections of the events, including images, thoughts, or perceptions;
(2) recurrent and distressing dreams about the event;
(3) acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated);
(4) intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event;
(5) physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three of the following:

(1) efforts to avoid thoughts, feelings, or conversations associated with the trauma;
(2) efforts to avoid activities, places, or people that arouse recollections of the trauma;
(3) inability to recall important parts of the trauma;
(4) markedly diminished interest in participating in significant activities;
(5) feelings of detachment or estrangement from others;
(6) restricted range of affect;
(7) sense of foreshortened future.

[a] Notes addressing PTSD in young children were removed.

Diagnostic criteria for Posttraumatic Stress Disorder according to the DSM-IV (continued).

D. Persistent symptoms of increased arousal (not present before the trauma) as indicated by two (or more) of the following:

(1) difficulty initiating or maintaining sleep;
(2) irritability and outbursts of anger;
(3) difficulty concentrating;
(4) hypervigilance;
(5) exaggerated startle response.

E. Duration of the disturbance (symptoms in Criteria B, C, and D) is more than one month.

F. The disturbance causes clinically significant distress and impairment in social, occupational, and other important areas of functioning.

Appendix B

Posttraumatic Symptom Scale

French version

Échelle des symptômes ESPT
(Version auto-évaluation)

Date _____ Numéro de dossier _____

Instructions:

A - Répondez aux questions suivantes:

Avez-vous déjà vécu un événement constituant une menace grave pour vous ou pour vos proches, un événement qui vous a occasionné une détresse importante? (Par exemple: vol à main armée, agression sexuelle, violence physique, accident, catastrophe, etc.)

Oui _____ Non _____

Si oui, quel était cet événement? (Précisez la date et votre âge à ce moment)

_____

_____

_____

B - Si vous avez répondu "oui" à la première question posée en A, veuillez répondre aux questions suivantes d'après ce qui s'est passé durant les deux dernières semaines en utilisant l'échelle de 0 à 3 ci-dessous:

0 = pas du tout

1 = 1 fois par semaine ou moins que ça,
ou un peu,
ou parfois.

2 = 2 à 4 fois par semaine,
ou assez souvent,
ou la moitié du temps.

3 = 5 fois ou plus par semaine,
ou beaucoup,
ou presque toujours.

Echelle de cotation

1) Durant les deux dernières semaines, avez-vous eu des pensées ou des images dérangeantes à propos de l'événement stresseur? _____

2) Durant les deüx dernières semaines, avez-vous eu des mauvais rêves ou des cauchemars à propos de l'événement stresseur? _____

3) Durant les deux dernières semaines, avez-vous vécu l'expérience de revivre l'événement, d'agir ou de vous sentir comme si l'événement stresseur se produisait à nouveau? _____

4)Durant les deux dernières semaines, avez-vous été très affecté émotionnellement lorsque vous vous remémorez l'événement (incluant devenir très apeuré, en colère, triste, etc.)? _____

5)Durant les deux dernières semaines, avez-vous eu des réactions physiques (par exemple: avoir des sueurs, le coeur qui bat très vite) lorsque vous vous remémorez l'événement? _____

6) Durant les deux dernières semaines, avez-vous essayé de ne pas penser ou de ne pas ressentir des émotions associées à l'événement? _____

7) Durant les deux dernières semaines, avez-vous fait des efforts pour éviter des activités, situations ou endroits qui vous rappellent l'événement? _____

8) Durant les deux dernières semaines, y a-t-il des aspects importants de l'événement dont vous ne pouvez toujours pas vous rappeler? _____

9) Durant les deux dernières semaines, avez-vous perdu de l'intérêt pour des activités que vous aimiez faire? _____

10) Durant les deux dernières semaines, vous êtes-vous senti distant ou isolé des autres autour de vous? _____

11) Durant les deux dernières semaines, vous êtes-vous senti émotionnellement "engourdi" (par exemple: vous êtes triste mais ne pouvez pas pleurer, vous êtes incapable de ressentir de l'amour, de l'affection)? _____

12) Durant les deux dernières semaines, considérez-vous que vos plans pour le futur ou vos espoirs ont changé à cause de l'événement stresseur (par exemple: ne pas avoir de carrière, de mariage, d'enfants ou une longue vie)? Ne pas inclure les déménagements. ____

13) Durant les deux dernières semaines, avez-vous eu des problèmes à vous endormir ou à rester endormi? ____

14) Durant les deux dernières semaines, avez-vous été plus irritable, ou eu des accès de colère? ____

15) Durant les deux dernières semaines, avez-vous eu des difficultés de concentration (par exemple: perdre le fil des conversations ou des histoires à la télévision, avoir de la difficulté à vous rappeler ce que vous avez lu)? ____

16) Durant les deux dernières semaines, avez-vous été exagérément vigilant (par exemple: vérifier pour voir qui est autour de vous, être inconfortable lorsque vous êtes dos à une porte)? ____

17) Durant les deux dernières semaines, a-t-il été facile de vous faire sursauter (par exemple: lorsque quelqu'un s'approche de vous par derrière)? ____

Total: ____ / 51

Référence: Version française de l'échelle ESPT selon les critères du DSM-IV, inspirée de Edna B. Foa. Pour de plus amples informations sur le test, voir: Foa et al., *Reliability and Validity of a Brief Instrument for Assessing Post-Traumatic Stress Disorder*, Journal of Traumatic Stress, (1993) Vol. 6, No. 4. Adaptation libre par Elisa Pucella, E1, révisée par Dr L.M. Larouche.

Appendix C

Clinician-Administered PTSD Scale (CAPS)

French Version

National Center for PTSD

CLINICIAN-ADMINISTERED PTSD SCALE (CAPS)

FORM 1 – Current and Lifetime Diagnosis Version

A. Événement traumatique

B. L'événement traumatique est vécu constamment

1) Souvenirs pénibles récurrents et gênants de l'événement

Fréquence	Intensité	C	L
Avez-vous déjà eu des souvenirs non souhaités de l'événement sans être exposé(e) à quoi que ce soit qui pourrait vous rappeler cet événement? Est-ce que ces souvenirs surviennent quand vous êtes éveillé(e) ou seulement dans vos rêves? (Exclure si les souvenirs surviennent seulement dans les rêves). À quelle fréquence dans le dernier mois?	Au pire moment, à quel point êties-vous bouleversé(e) ou inconfortable par ces souvenirs? Est-ce que ces souvenirs vous obligent à arrêter ce que vous faisiez? Si vous tentez d'oublier ces souvenirs, y parvenez-vous?	QV	QV
0 Jamais	0 Aucun	F	F
1 Une ou deux fois	1 Léger, bouleversement mineur		
2 Une ou deux fois par semaine	2 Modéré, bouleversement nettement présent mais encore capable d'y faire face	I	I
3 Plusieurs fois par semaine	3 Sévère, bouleversement important, arrêt des activités et difficulté à oublier les souvenirs		
4 A tous les jours ou presque	4 Extrême, bouleversement paralysant, incapable de continuer ses activités et d'oublier ses souvenirs		
Description : Exemples :			

2. Détresse psychologique intense lorsqu'exposé à des événements symbolisants ou semblables à un aspect de l'événement traumatique, incluant la date anniversaire du traumatisme

Fréquence	Intensité	C	L
Avez-vous déjà été contrarié(e) lorsque vous avez été exposé(e) à un élément vous rappelant l'événement? (Par exemple, hommes particuliers pour victimes d'abus sexuel, rangée d'arbres pour vétérans). À quelle fréquence dans le dernier mois?	Au pire moment, à quel point êties-vous bouleversé(e) ou inconfortable par ces éléments vous rappelant l'événement?	QV	QV
0 Jamais	0. Aucun	F	F
1 Une ou deux fois	1. Léger, bouleversement mineur		
2 Une ou deux fois par semaine	2. Modéré, bouleversement nettement présent mais encore capable d'y faire face	I	I
3 Plusieurs fois par semaine	3. Sévère, bouleversement important,		
4 A tous les jours ou presque	4. Extrême, bouleversement paralysant		
Description : Exemples :			

(3) Agissement ou sentiment soudain comme si l'événement traumatique se reproduisait (inclut une impression de revivre l'expérience, illusions, hallucinations et épisodes dissociatifs (feedback) même ceux qui surviennent durant l'éveil ou lors d'une intoxication)

Fréquence
Avez-vous déjà soudainement agi ou ressenti comme si l'événement se produisait à nouveau? À quelle fréquence dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 A tous les jours ou presque

Description : Exemples :

Intensité
Au pire moment, à quel point vous semblait-il que l'événement se produisait à nouveau? Combien de temps cela dura-t-il? Que faisiez-vous pendant que cela se produisait?

0 Aucunement
1 Léger, un peu plus réaliste que de juste y penser
2 Modéré, défini mais qualité dissociative transitoire
3 Sévère, fortement dissociatif (rapporte ds images, sounds, odeurs) mais conserve une certaine conscience de l'environnement
4 Extrême, dissociation complète (flashback). Aucune conscience de l'environnement, possible amnésie de l'épisode (blackout)

C	L
QV	QV
F	F
I	I

(4) Rêves pénibles récurrents de l'événement

Fréquence
Avez-vous déjà fait des rêves déplaisants à propos de l'événement? À quelle fréquence cela s'est-il produit dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 A tous les jours ou presque

Description : Exemples :

Intensité
Au pire moment, à quel point ces rêves vous angoissent-ils ou vous rendent-ils inconfortables? Est-ce que ces rêves vous réveillent? (Si oui, demandez : Comment vous sentiez-vous ou que faisiez-vous quand vous vous êtes réveillé? Combien de temps cela vous prend-il pour vous rendormir? (être attentif aux symptômes de panique, cris, posture)

0 Aucun
1 Léger, angoisse mineure, pas de réveil
2 Modéré, se réveille angoissé mais peut se rendormir facilement
3 Sévère, angoisse importante, difficulté à se rendormir
4 Extrême, angoisse paralysante, ne peut se rendormir

C	L
QV	QV
F	F
I	I

Symptômes courants du Critère B = _____

Symptômes à vie du Critère B = _____

C. Évitement persistant de stimuli associés au traumatisme ou paralysie des réponses générales (non présent avant le traumatisme)

(5) Efforts pour éviter des pensées ou sentiments associés au traumatisme

Fréquence
Avez-vous déjà essayé d'éviter de penser à l'événement? Avez-vous déjà éviter de ressentir des émotions reliées à l'événement (ex : rage, tristesse, culpabilité)? À quelle fréquence dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 A tous les jours ou presque

Description : Exemples :

Intensité
Quels efforts avez-vous fait pour éviter de penser ou de ressentir des émotions reliées à l'événement? (coter toutes les tentatives d'évitement cognitif incluant distractions, suppression et altérations de conscience par alcool ou drogue)

0 Aucun
1 Léger, effort minime
2 Modéré, quelques efforts, évitement définitivement présent
3 Sévère, effort considérable, évitement marqué
4 Extrême, tentatives drastiques d'évitement

C	L
QV	QV
F	F
I	I

(6) Efforts pour éviter des activités ou situations qui éveillent des souvenirs du traumatisme

Fréquence
Avez-vous déjà tenté de rester à l'écart d'activités ou de situations qui vous rappellent l'événement? À quelle fréquence dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 A tous les jours ou presque

Description : Exemples :

Intensité
Quels efforts avez-vous fait pour éviter des activités ou des situations reliées à l'événement? (coter toute tentative d'évitement comportemental ex : vétérans qui évitent des films de guerre)

0. Aucun
1. Léger, bouleversement mineur
2. Modéré, bouleversement nettement présent mais encore capable d'y faire face
3. Sévère, bouleversement important,
4. Extrême, bouleversement paralysant

C	L
QV	QV
F	F
I	I

(7) Incapacité de se souvenir d'aspects importants du traumatisme (amnésie psychogénique)

Fréquence
Avez-vous déjà été incapable de vous souvenir de parties importantes de l'événement (ex : noms, visages, séquences d'événement)? Combien d'aspects de l'événement avez-vous eu de la difficulté à vous rappeler dans le dernier mois?

0 Aucun
1 Peu d'aspects de l'événement non rappelés (moins de 10%)
2 Quelques aspects de l'événement non rappelés (approx 20-30%)
3 Plusieurs aspects de l'événement non rappelés (approx 50-60%)
4 Majorité de l'événement non rappelée (plus de 80%)

Description : Exemples :

Intensité
Quelle difficulté avez-vous eu à vous souvenir de parties importantes de l'événement?

0 Aucune difficulté à se souvenir
1 Léger, difficulté minime à se souvenir l'événement
2 Modéré, quelques difficultés, peut se rappeler certains événements en se concentrant
3 Sévère, difficulté considérable à se rappeler l'événement
4 Extrême, bouleversement paralysant, complètement incapable de se rappeler de l'événement

C	L
QV	QV
F	F
I	I

(8) Intérêt nettement diminué dans des activités significatives

Fréquence
Avez-vous moins d'intérêt dans des activités importantes qui vous ont déjà donné du plaisir comme les sports, passe-temps ou des activités sociales? Comparé à avant l'événement, combien d'activités dans le dernier mois avez-vous eu moins d'intérêt à faire?

0 Aucune perte d'intérêt
1 Peu d'activités (moins de 10%)
2 Quelques activités (approx 20-30%)
3 Plusieurs activités (approx 50-60%)
4 Presque toutes les activités (plus de 80%)

Description : Exemples :

Intensité
Au pire moment, à quel point avez-vous perdu de l'intérêt dans ces activités?

0. Aucune perte d'intérêt
1. Léger, seulement faible perte d'intérêt, aimerait probablement après avoir commencé l'activité
2. Modéré, perte d'intérêt définie mais peut avoir un peu de plaisir dans les activités
3. Sévère, perte marquée d'intérêt dans les activités
4. Extrême, perte complète d'intérêt, ne s'engage dans une aucune activité intentionnellement

C	L
QV	QV
F	F
I	I

(9) Sentiments de détachement ou d'éloignement des autres

Fréquence
Vous êtes-vous déjà senti éloigné ou coupé des gens qui vous entourent? Est-ce différent de ce que vous ressentiez avant l'événement? Quelle portion de temps vous êtes-vous senti comme ca dans le dernier mois?

0 Jamais
1 Très peu (moins de 10%)
2 Un peu (approx 20-30%)
3 Plupart du temps (approx 50-60%)
4 Tout le temps (plus de 80%)

Description : Exemples :

Intensité
Au pire moment, à quel point vous sentiez-vous distant ou coupé des autres? De qui vous sentiez-vous proche?

0 Aucun sentiment de détachement ou d'éloignement
1 Léger, se sent occasionnellement à part des autres
2 Modéré, sentiments de détachement clairement présents mais ressent encore des liens interpersonnels
3 Sévère, sentiments marqués de détachement ou d'éloignement de la plupart des gens, peut n'avoir qu'un confident
4 Extrême, se sent complètement détaché ou loin des autres. Pas près de personne

C	L
QV	QV
F	F
I	I

(10) Champ restreint d'émotions (ex : incapable de ressentir de l'amour)

Fréquence
Avez-vous déjà eu des périodes où vous étiez émotivement paralysé ou aviez de la difficulté à ressentir des émotions comme l'amour ou le bonheur?Est-ce différent de ce que vous ressentiez avant l'événement? À quelle fréquence vous êtes-vous senti ainsi dans le dernier mois?

0 Jamais
1 Très peu de fois (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Presque ou tout le temps (plus de 80%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient vos sentiments de torpeur émotionelle? (en cotant, inclure vos observations dude l'étendue des émotions durant l'interview)

0 Aucune perte d'intérêt
1 Léger, légère torpeur émotionnelle
2 Modéré, torpeur émotionnelle clairement présente mais peut encore ressentir des émotions
3 Sévère, torpeur émotionnelle marquée dans au moins deux émotions primaires (ex : amour, bonheur)
4 Extrême, se sent complètement apathique

C	L
QV	QV
F	F
I	I

(11) Impression d'un futur sombre (ex : n'a pas d'attentes de carrière, mariage, enfants ou une longue vie)

Fréquence

Avez-vous déjà eu des moments où vous sentiez que vous n'aviez pas besoin de faire de plans pour le futur, que de toute façon, votre futur ne sera pas long? (Si oui, exclure les risques réalistes comme les conditions médicales morbides) Est-ce différent de ce que vous ressentiez avant l'événement? À quelle fréquence vous sentiez-vous ainsi dans le dernier mois?

0 Jamais
1 Très peu de fois (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Presque ou tout le temps (plus de 80%)

Description : Exemples :

Intensité

Au pire moment, quelle force avaient vos sentiments comme quoi votre future serait de courte durée? Combien d'années croyez-vous vivre? À quel point êtes-vous convaincu que vous allez mourir prématurément?

0 Aucun sentiment de futur sombre
1 Léger, léger sens de futur sombre
2 Modéré, sentiment de futur sombre définitivement présent mais aucune prédiction spécifique sur sa longévité
3 Sévère, sentiment marqué de futur sombre, peut faire des prédictions spécifiques sur sa longévité
4 Extrême, sentiment écrasant de futur sombre, totalement convaincu d'une mort prématurée

C	L
QV	QV
____	____
F	F
____	____
I	I

Symptômes courants du Critère C = _____

Symptômes à vie du Critère C = _____

D . Symptômes persistants d'éveil augmenté (non présent avant le traumatisme)

(12) Difficultés à s'endormir ou à rester endormi

C	L
QV	QV
F	F
I	I

Fréquence
Avez-vous déjà eu des problèmes à vous endormir ou à rester endormi? Est-ce différent de vos habitudes de sommeil que vous aviez avant l'événement? À quelle fréquence avez-vous eu des problèmes de sommeil dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 Toutes les nuits ou presque

Problèmes à s'endormir? O N

Réveil en milieu de nuit? O N

Réveil tôt le matin? O N

total d'heures de sommeil/nuit :

heures désirées par nuit :

Intensité
Combien de temps prenez-vous pour vous endormir? Combien de fois vous réveillez-vous durant la nuit? Combien d'heures au total dormez-vous durant la nuit?

0 Aucun problème à dormir
1 Léger, prend un peu de temps à s'endormir ou difficulté minime à rester endormi (jusqu'à 30 minutes de perte de sommeil)
2 Modéré, problèmes définitifs de sommeil, période clairement plus longue pour s'endormir ou difficulté claire à rester endormi (30 à 90 minutes de perte de sommeil)
3 Sévère, plus longue période d'attente pour dormir ou difficulté marquée pour rester endormi (90 minutes à 3 heures de perte de sommeil)
4 Extrême, très longue période d'attente pour dormir ou difficulté profonde à rester endormi (plus de 3 heures de perte de sommeil)

(13) Irritabilité ou excès de colère

C	L
QV	QV
F	F
I	I

Fréquence
Y a-t-il eu des fois où vous vous êtes senti inhabituellement irritable ou que vous avez exprimé des émotions de colère et avez agi avec agressivité? Est-ce différent de comment vous vous sentiez ou agissiez avant les événements? À quelle fréquence vous êtes-vous senti ou avez-vous agi ainsi dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 Tous les jours ou presque

Description : Exemples :

Intensité
À quel point étiez-vous en colère? De quelle façon avez-vous exprimé cette colère?

0 Pas d'irritabilité ou de colère
1 Léger, irritabilité minime, lève la voix quand en colère
2 Modéré, irritabilité clairement présente, argumente facilement lorsqu'en colère mais peut se calmer rapidement
3 Sévère, irritabilité marquée, devient physiquement ou verbalement agressif lorsqu'en colère
4 Extrême, colère envahissante, épisodes de violence physique

(14) Difficultés de concentration

Fréquence
Avez-vous eu de la difficulté à vous concentrer sur ce que vous faisiez ou sur les choses autour de vous? Est-ce que votre concentration a changé depuis l'événement? À quelle fréquence avez-vous eu de la difficulté à vous concentrer lors du dernier mois?

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment des cas, à quel point était-ce difficile de vous concentrer? (en cotant cet item, inclure les observations de concentration et d'attention durant l'interview)

0 Aucune difficulé à se concentrer
1 Léger, léger effort de concentration nécessaire
2 Modéré, perte définie de concentration mais peut se concentrer en s'efforcant.
3 Sévère, perte marquée de concentration même avec effort
4 Extrême, impossibilité totale à se concentrer

C	L
QV	QV
F	F
I	I

(15) hypervigilance

Fréquence
Avez-vous été particulièrement alerte ou attentif même si rien ne l'exigeait? Est-ce différent de comment vous vous sentiez ou agissiez avant l'événement? À quelle fréquence avez-vous été alerte ou attentif dans le dernier mois?

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Quelle effort avez-vous fait pour rester vigilant des choses autour de vous? (en cotant, inclure observations d'hypervigilance durant l'entrevue)

0 Pas d'hypervigilance
1 Léger, hypervigilance minime, légère augmentation d'attention
2 Modéré, hypervigilance clairement présente, attentif en public (ex : cherche places sécuritaires pour s'asseoir au resto)
3 Sévère, hypervigilance marquée, très alerte, analyse l'environnement pour dangers, intérêt exagéré pour sa sécurité (et celle de sa demeure et de sa famille)
4 Extrême, hypervigilance excessive, efforts pour assurer sécurité prend beaucoup de son temps et énergie, peut demander comportements de sécurité excessif, comportement de surveillance marqué durant l'entrevue

C	L
QV	QV
F	F
I	I

(16) Sursaut exagéré

Fréquence
Avez-vous déjà fait de gros sursauts à cause de bruits forts et inattendus (ex: freinage d'auto, pétards, porte claquée,...) ou choses que vous avez vus? (ex: mouvement dans le coin de l'œil)? Est-ce différent d'avant l'événement? À quelle fréquence est-ce arrivé dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 Tous les jours ou presque

Description : Exemples :

Intensité
Au pire moment, quelle force avait ces sursauts?

0 Aucune réaction de sursaut
1 Léger, sursaut minime
2 Modéré, sursaut définitif, se sent nerveux
3 Sévère, sursaut marqué, sursaut, excitation soutenue après le sursaut
4 Extrême, sursaut excessif, comportement « overt coping »

C	L
QV	QV
F	F
I	I

(17) Réaction physiologique lorsqu'exposé à des événements qui symbolisent ou ressemblent à un aspect du traumatisme

Fréquence
Avez-vous eu des réactions physiques lorsque vous avez été confronté à des situations qui vous rappellaient l'événement? (être attentif à des symptômes comme palpitation cardiaque, énergique, transpirer, tension musculaire mais ne pas suggérer de symptômes). À quelle fréquence dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 Tous les jours ou presque

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces réactions physiques?

0 Pas de réaction physique
1 Léger, réaction minimale
2 Modéré, réaction physique clairement présente, rapporte un peu d'inconfort
3 Sévère, réaction physique marquée, rapporte inconfort important
4 Extrême, réaction physique extrême, excitation soutenue

C	L
QV	QV
F	F
I	I

Symptômes courants du Critère D = _____

Symptômes à vie du Critère D = _____

COTATION GLOBALE CAPS

(18) Impact sur le fonctionnement social : Est-ce que les symptômes que vous m'avez mentionnés affectent votre vie sociale? Evaluez l'impact global que les symptômes SSPT ont eu sur le fonctionnement social du patient en prenant en considération vos impressions des comportements du patient ainsi que que ses déclarations à d'autres moments durant l'entrevue.

0 Aucun impact négatif sur le fonctionnement social
1 Impact faible ou léger sur le fonctionnement social, quelques diminutions
2 Impact moyen sur le fonctionnement social
3 Impact sévère sur le fonctionnement social
4 Impact extrême sur le fonctionnement social

(19) Impact sur le fonctionnement au travail : Travaillez-vous présentement? Est-ce que les symptômes dont vous m'avez parlé affectent votre travail ou votre capacité de travailler? Evaluez l'impact global que les symptômes SSPT ont eu sur la capacité du patient à obtenir ou maintenir un emploi. Prendre en considération le récit du patient concernant son travail incluant le nombre et la durée des emplois de même que la qualité de ses rapports de travail. Considérer également les problèmes de fonctionnement au travail causés par autre chose que les symptômes SSPT

0 Aucun impact négatif sur le fonctionnement au travail
1 Impact faible ou léger sur le fonctionnement au travail, quelques difficultés
2 Impact moyen sur le fonctionnement au travail,
3 Impact sévère sur le fonctionnement au travail
4 Impact extrême sur le fonctionnement au travail

(20) Amélioration générale : Evaluez l 'amélioration générale présente depuis la première évaluation. S'il n'y a pas eu de première évaluation, demander si les symptômes ont changé dans les 6 derniers mois. Evaluez le degré de changement que ce soit dû ou non au traitement.

0 Asymptomatique
1 Beaucoup d'amelioration
2 Amélioration moyenne
3 Amélioration legere
4 Aucune amélioration ou pas assez d'informations

(21) Evaluation de la validité : Nombre total de QV encerclés durant l'entrevue : _____

Évaluez la validité globale de l'évaluation obtenue. Certains facteurs peuvent influencer la validité incluant la coopération du patient et ses tentatives de paraître plus ou moins symptomatique que ce n'est réellement le cas. De plus, le type et l'intensité des symptômes SSPT présents peuvent interférer avec la concentration, l'attention ou la capacité de communiquer du patient de facon cohérente.

0 Asymptomatique
1 Beaucoup d'amélioration
2 Amélioration moyenne
3 Amélioration légère
4 Aucune amélioration ou pas assez d'informations

(22) Sévérité générale : Evaluation par l'interviewer de l'intensité générale des symptômes SSPT du patient. Considérez le degré de détresse rapporté par le patient, les symptômes observés et les difficultés de fonctionnement rapportées. Votre jugement est requis en mettant l'emphase sur les informations particulières de même que sur la précision des réponses du patient. Ce jugement peut être basé sur l'information obtenue durant cette entrevue seulement.

0	Asymptomatique
1	Peu ou symptôme léger, un peu de difficultés à fonctionner
2	Symptômes moyens mais fonctionne de facon satisfaisante en s'efforcant
3	Symptômes sévères, fonctionnement limité même en s'efforcant
4	Symptômes extrêmes, difficultés envahissantes

Symptômes courants

	Cx A rencontré?	Non	Oui
_____	# symptômes courants pour Critère B – Cx B rencontré (≥1)?	Non	Oui
_____	# symptômes courants pour Critère C –Cx C rencontré (≥3)?	Non	Oui
_____	# symptômes courants pour Critère D –Cx D rencontré (≥2)?	Non	Oui
	SSPT (Critères A-D rencontré)?	Non	Oui

Si les critères SSPT sont rencontrés, ne pas faire l'autre section et aller directement à « Particularités associées ou hypothétiques ». Si les critères ne sont pas rencontrés, faire le Questionnaire de symptômes à vie.

Questionnaire de symptômes à vie

Avez-vous déjà eu des périodes depuis le traumatisme où vous étiez significativement plus troublé que lors du dernier mois par les symptômes que je viens juste de vous demander? Non Oui

Est-ce que cette période ou ces périodes a duré plus d'un mois? Non Oui

Approximativement, quand cette/ces période(s) a/ont duré ____ to ____
____ to ____
____ to ____

(Pour périodes multiples) :

Durant laquelle de ces périodes étiez-vous le plus troublé ou avez expérimenté le plus grand nombre de symptômes? ____ to ____

Pour la période indiquée ci-haut, demandez pour chaque symptôme des items 1-17. Changez les questions de fréquence en commencant par « Durant le mois que vous avez identifié comme étant le pire moment, avez-vous expérimenté (symptôme). À quelle fréquence est-ce que (symptôme) est apparu?

Symptômes de vie

Critère A Critère A rencontré? Non Oui

_____ # symptômes pour Critere B – Critère B rencontré (≥1)? Non Oui

_____ # symptômes pour Critere C –Critère C rencontré (≥3)? Non Oui

_____ # symptômes pour Critere D –Critère D rencontré (≥2)? Non Oui

SSPT (Criteres A-D rencontrés)? Non Oui

E . Particularités associées ou hypothétiques

(23) Culpabilité d'avoir agi ou de ne pas avoir agi

Fréquence
Depuis l'événement, vous êtes-vous senti coupable à propos d'un comportement que vous avez eu ou de ne pas avoir agi d'une certaine façon pendant l'événement? À quelle fréquence vous êtes-vous senti ainsi dans le dernier mois?

0 Jamais
1 Très rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 La plupart du temps (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments de culpabilité?

0 Aucune culpabilité
1 Léger, culpabilité minimal
2 Moyen, culpabilité clairement présente, encore capable de gérer sa culpabilité
3 Sévère, culpabilité considérable, difficulté à gérer un inconfort marqué
4 Extrême, culpabilité excessive, tourmenté en se condamnant lui-même

C	L
QV	QV
F	F
I	I

(24) culpabilité de survie

Fréquence
Depuis l'événement, vous êtes-vous déjà senti coupable d'avoir survécu quand d'autres (autour de vous) n'ont pas survécu? À quelle fréquence dans le dernier mois?

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments de culpabilité?

0 Aucune culpabilité
1 Léger, culpabilité minime
2 Modéré, culpabilité clairement présente mais encore capable d'y faire face
3 Sévère, culpabilité considérable, inconfort marqué avec difficulté à y faire face
4 Extrême, culpabilité excessive, tourmenté par auto-condamnation

C	L
QV	QV
F	F
I	I

(25) Homicide

C	L
QV	QV
F	F
I	I

Fréquence
Avez-vous déjà eu des moments où vous avez senti que vous blesseriez ou tueriez quelqu'un? Est-ce différent de comment vous étiez avant l'événement? À quelle fréquence vous êtes-vous senti ainsi dans le dernier mois?

0 Jamais
1 Une ou deux fois
2 Une ou deux fois par semaine
3 Plusieurs fois par semaine
4 À tous les jours ou presque

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments de vouloir blesser ou tuer quelqu'un?

0 Aucun désir de tuer
1 Léger, idée d'homicide très légère
2 Moyen, idées d'homicide définies mais aucune intention actuellement
3 Sévère, idées d'homicide fortes, a déjà considéré fortement de tuer mais aucun plan défini
4 Extrême, désirs de tuer très forts, plans formulés ou déjà fait une tentative de meurtre

(26) Désillusion d'une autorité précédement estimée et de figures d'autorité

C	L
QV	QV
F	F
I	I

Fréquence
Depuis l'événement, avez-vous déjà eu des pensées qu'une figure d'autorité vous a laissé tomber ou qu'elle vous trompait ou trahissait durant ou après l'événement? À quelle fréquence dans le dernier mois

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments d'être abandonné par l'autorité?

0 Aucune désillusion
1 Léger, désillusion minimale
2 Modéré, désillusion définie mais peut encore interagir avec ceux détenant l'autorité
3 Sévère, désillusion considérable, difficulté à interagir avec ceux détenant l'autorité
4 Extrême, désillusion complète, incapable d'interagir avec ceux détenant l'autorité

(27) Sentiments de désespoir

Fréquence
Avez-vous déjà eu l'impression qu'il y avait peu ou pas d'espoir d'éamliorer votre état d'esprit ou améliorer la situation dans laquelle vous vous trouvez? Est-ce différent d'avant l'événement? À quelle fréquence vous êtes-vous senti ainsi dans le dernier mois?

0 Jamais
1 Très rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 La plupart du temps (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments de désespoir? (considérez les objectifs de traitement de la part du patient, buts pour les tentatives de socialisation et de travail)

0 Aucun désespoir
1 Léger, légère perte d'espoir
2 Moyen, perte définie d'espoir mais encore capable de fonctionner de façon efficace
3 Sévère, perte considérable d'espoir, a le goût de tout abandonner
4 Extrême, complète perte d'espoir, voit toutes les possibilités d'amélioration comme futiles.

C	L
QV	QV
F	F
I	I

(28) Pertes de mémoire, oubli

Fréquence
Avez-vous dernièrement des difficultés à vous rappeler certaines choses? Est-ce que différent de ce que c'était avant l'événement? À quelle fréquence avez-vous eu des pertes de mémoire dans le dernier mois?

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
À quel point avez-vous ou avez-vous eu des difficultés dernièrement à vous rappeler certaines choses? (en évaluant cet item, inclure les observations sde déficit de la mémoire à court terme durant l'entrevue)

0 Aucune difficulté
1 Léger, légères difficultés à se souvenir, oublis mineurs
2 Modéré, pertes de mémoire définies, mais peut se rappeler la plupart des choses aisément
3 Sévère, pertes de mémoire considérables, oublie plusieurs choses facilement
4 Extrême, profondes pertes de mémoire, oubli même les choses importantes ou rendez-vous

C	L
QV	QV
F	F
I	I

(29) Tristesse et dépression

Fréquence
Ya –t-il déjà eu des fois où vous vous êtes senti triste ou déprimé? Est-ce que différent de comment vous vous sentiez avant l'événement? À quelle fréquence vous êtes-vous senti triste ou déprimé dans le dernier mois?

0 Jamais
1 Très rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 La plupart du temps (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment, quelle force avaient ces sentiments de tristesse ou de dépression?

0 Aucune tristesse ou dépression
1 Léger, tristesse ou dépression minime
2 Moyen, tristesse ou dépression définie mais encore capable d'y faire face
3 Sévère, dépression considérable, rapporte se sentir tomber dans un état de tristesse ou de dépression
4 Extrême, dépression envahissante

C	L
QV	QV
F	F
I	I

(30) Sentiment de se sentir dépassé

Fréquence
Y a-t-il eu des fois où vous vous êtes senti dépassé par les événements ou incapable de supporter la pression? Est-ce différent de ce que c'était avant l'événement? À quelle fréquence vous êtes vous senti ainsi dans le dernier mois?

0 Jamais
1 Rarement (moins de 10%)
2 Quelques fois (approx 20-30%)
3 Plusieurs fois (approx 50-60%)
4 Tout le temps ou presque (plus de 90%)

Description : Exemples :

Intensité
Au pire moment des cas, quelle force avaient ces sentiments de vous sentir dépassé par les événements?

0 Aucun sentiment d'être incapable de supporter la pression
1 Léger, sentiments légers d'être incapable de supporter la pression
2 Modéré, sentiments définis d'incapacité de supporter la pression mais peut encore la surmonter
3 Sévère, sentiments forts d'incapacité à supporter la pression
4 Extrême, sentiments paralysants d'être incapable de supporter la pression, se sent complètement dépassé par les événements

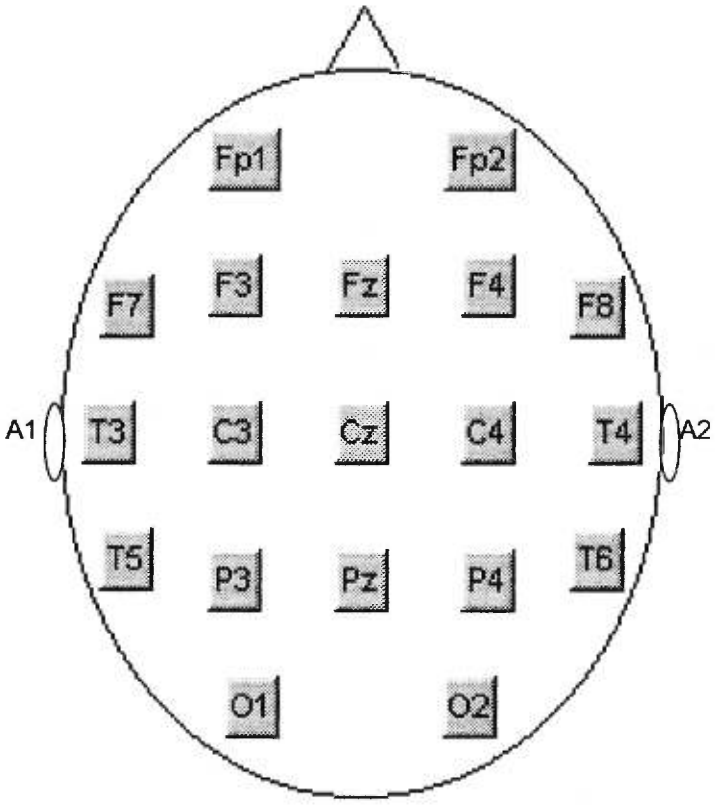
C	L
QV	QV
F	F
I	I

Appendix D

International 10-20 system of electrode placements for EEG recordings

International 10-20 system of electrode placement for EEG recordings (Jasper, 1958).

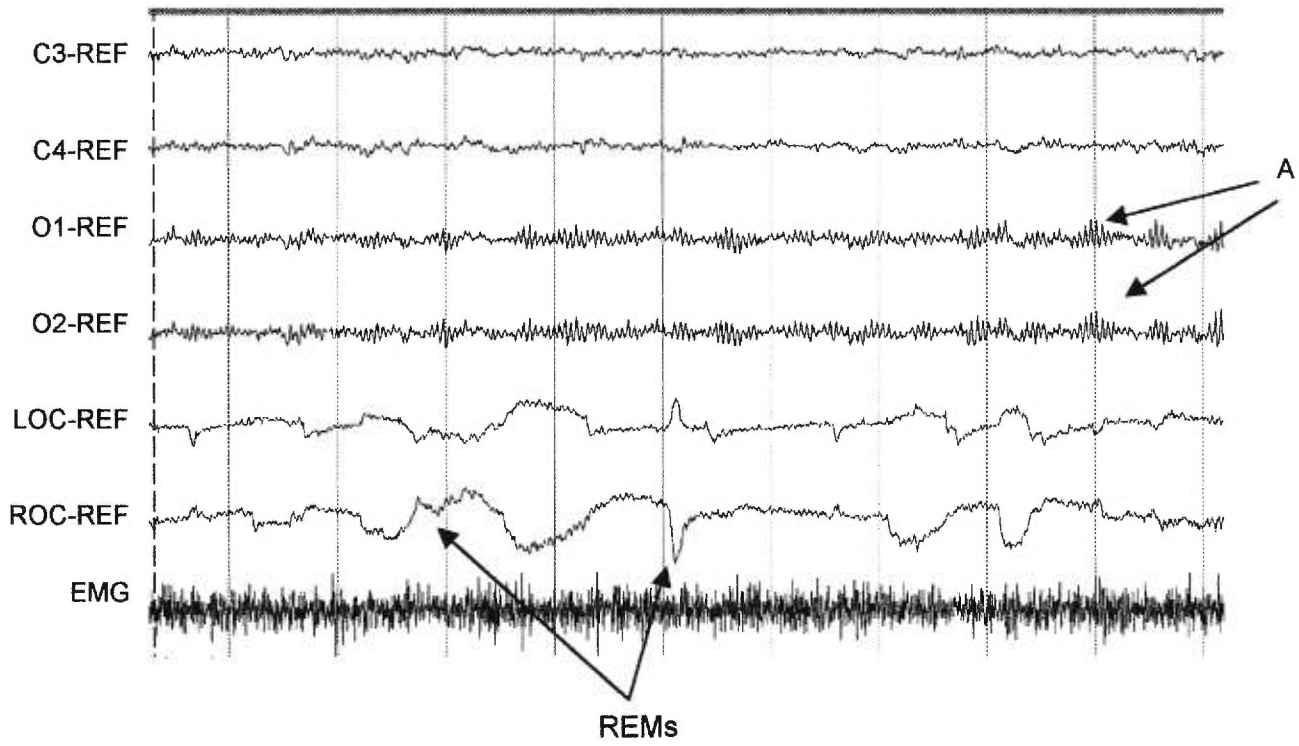
Each square on the scalp represents a specific recording site over five areas: frontal (F), temporal (T), central (C), parietal (P), and occipital (O). A1 and A2 are used as reference electrodes and are placed on the earlobes. As earlobes are silent sites (i.e. no activity is recorded), the EEG signal recorded at each site is equal to the electric potential difference between the EEG recording site and the sum of A1 + A2. The A1 + A2 will be referred to as REF (reference leads) in Appendix 4.



Appendix E
Presentation of sleep stages

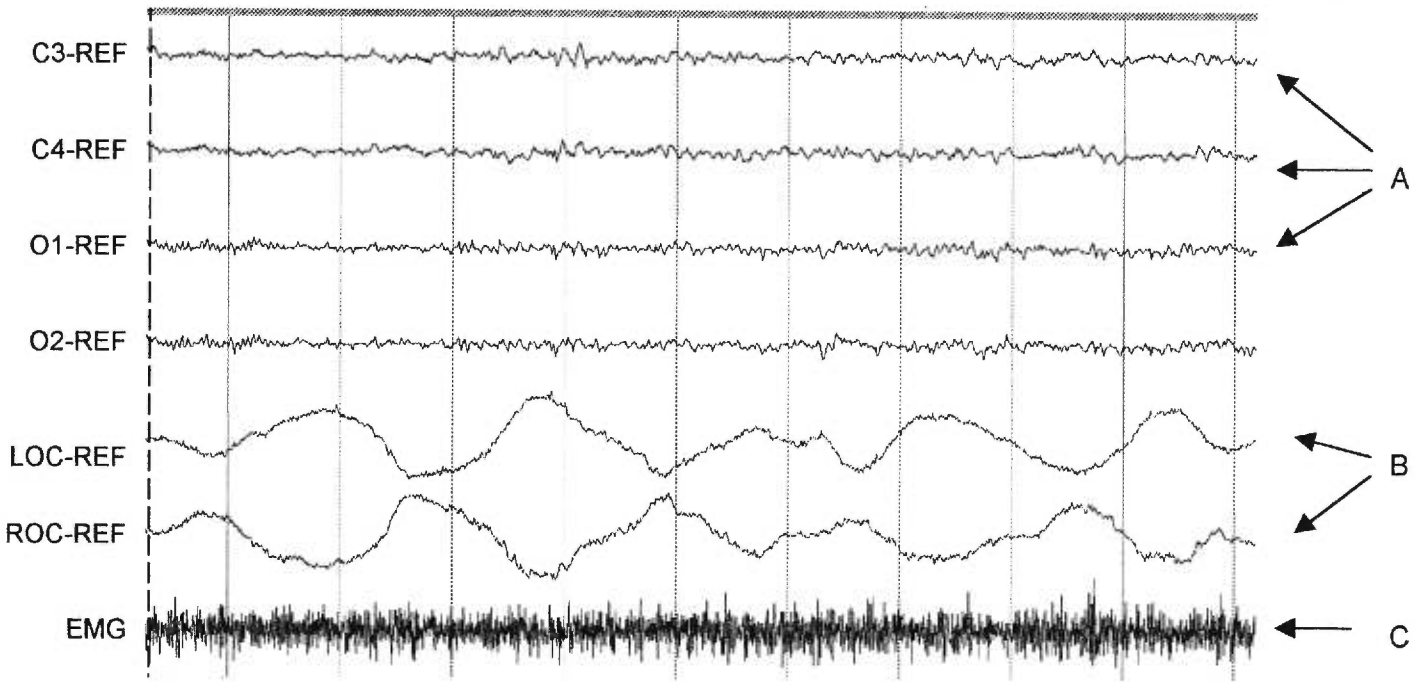
Relaxed Wakefulness (Stage W)

EEG records of relaxed wakefulness consist mainly of continuous alpha waves (A). Rapid eye movements (REMs) can be observed. EMG levels are relatively elevated.



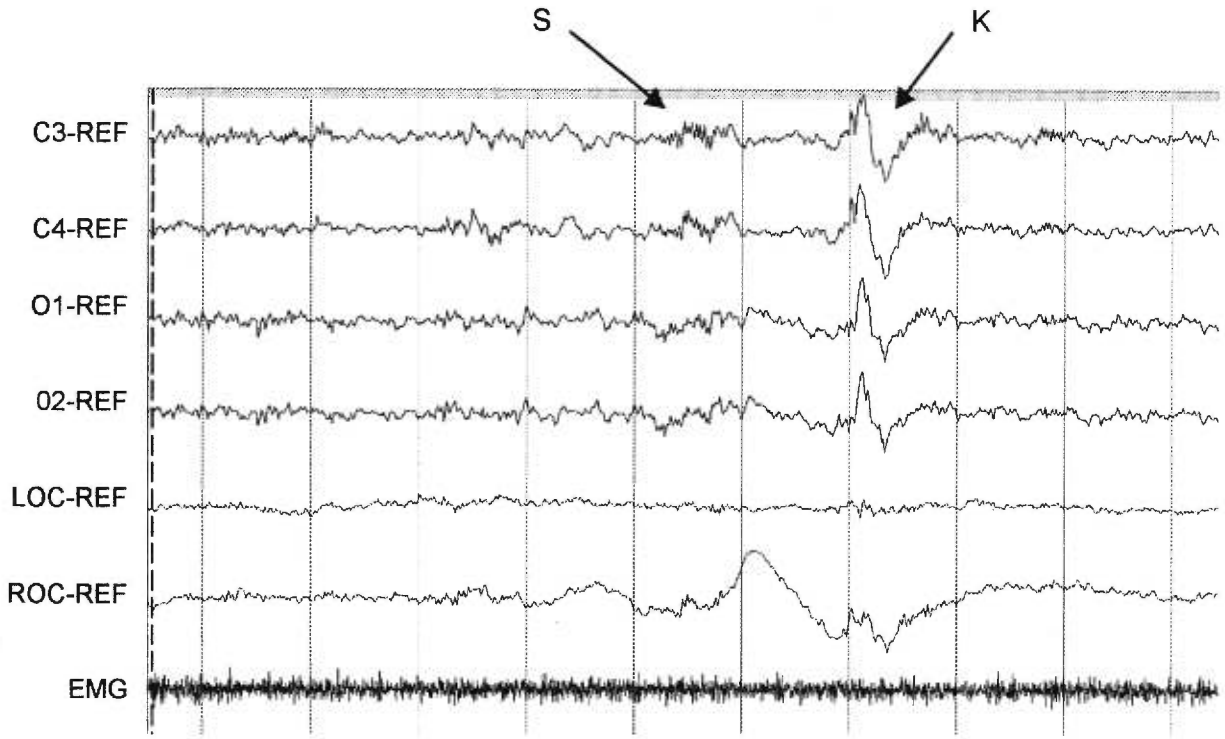
Stage 1 sleep

Stage 1 sleep occurs in the transition from wakefulness to other sleep stages. EEG activity recorded with a referential montage at C3, C4, O1, and O2 show the relatively low voltage, mixed EEG frequency (A). Ocular recordings on the left (LOC) and right (ROC) side show slow eye movements (B). The tonic EMG level (C) is below that of relaxed wakefulness.



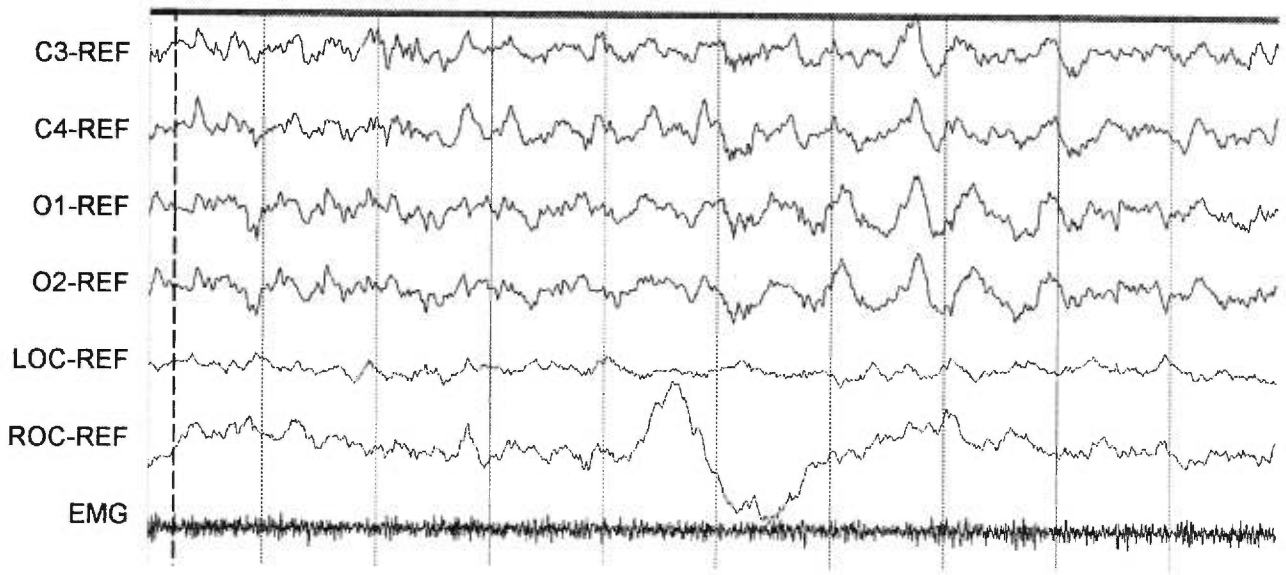
Stage 2 sleep

Stage 2 sleep is characterized by the presence of sleep spindles (S; trains of alpha waves of lasting at least 0.5 sec) and K-complexes (K; negative sharp wave immediately followed by a positive component). Ocular activity is minimal, and EMG levels are slightly reduced compared to Sage 1.



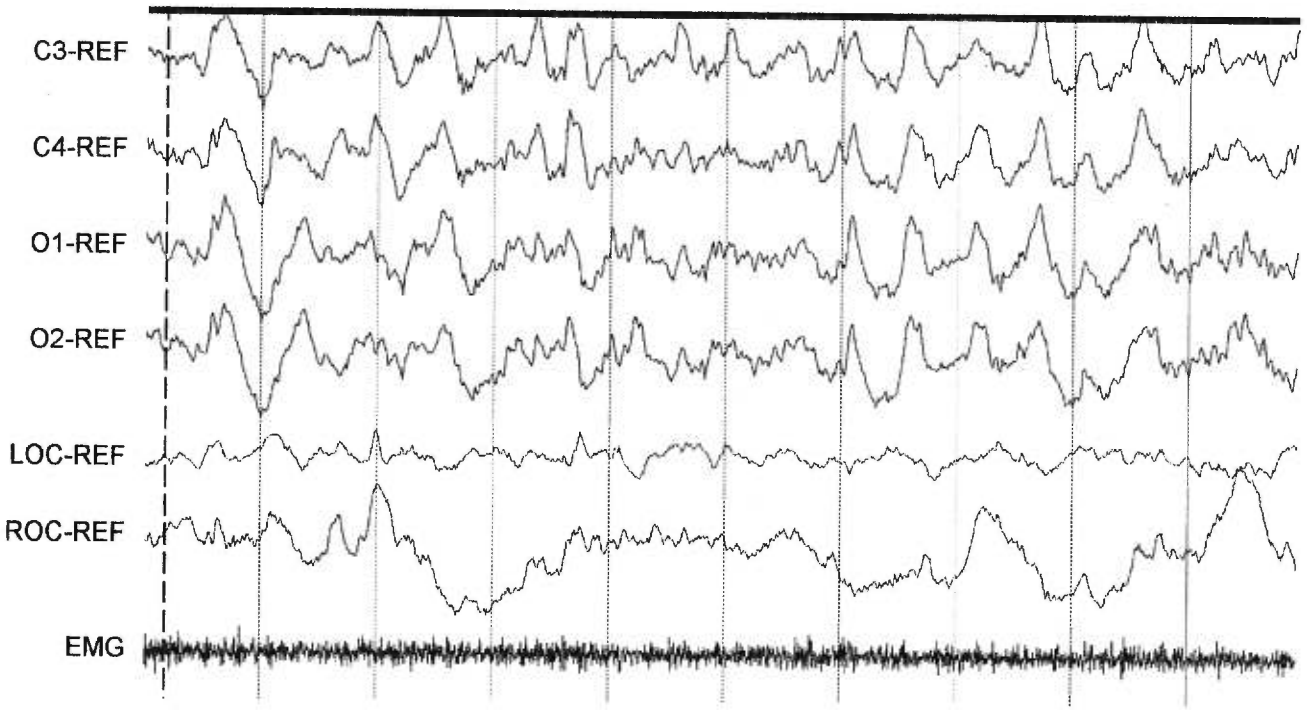
Stage 3 sleep

Stage 3 sleep is characterized by low-frequency, high-amplitude EEG recordings. Between 20% but no more than 50% of the 30-second epoch consists of these slow waves. Eyes are quiescent but the EEG high amplitude contaminates the EOG channels (LOC and ROC). EMG remains to a level similar to that achieved in Stage 2 sleep.



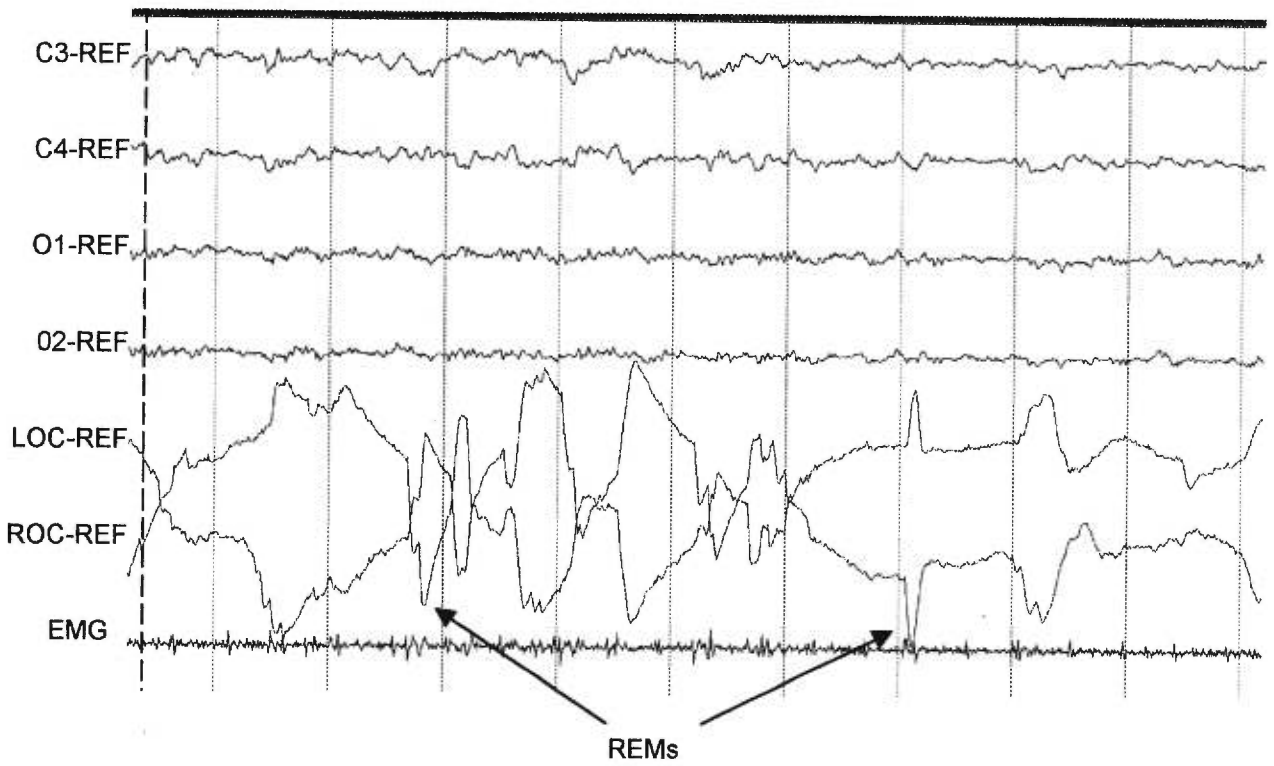
Stage 4 sleep

Stage 4 sleep is defined by a record of low frequency, high amplitude EEG which is more than 50% of the 30-second epoch.



Rapid-eye-movement (REM) sleep

REM sleep is characterized by high-frequency, low-amplitude EEG, resembling that of wakefulness. Synchronized rapid eye movements (REM) are easily identified. Muscle atonia can be observed on the EMG channel and is always lower than the EMG levels of preceding sleep stages.



Appendix F

Operational definitions of polysomnographic measures

Table 1. Sleep measures commonly assessed with polysomnography and their operational definitions.

Measure	Operational Definition
Sleep onset latency (SO)	Time interval in minutes between lights out and the first episode of sleep, defined as appearance of three consecutive epochs of stage 1 sleep, or one epoch of any other sleep stage.
Total Sleep Time (TST)	Total number of minutes spent asleep, excluding body movements, awakenings, and micro-arousals.
Time in Bed (TIB)	Total recording time in minutes
Sleep Efficiency (SE)	Ratio of TST / TIB
Wake time after sleep onset (WASO)	Total time spent awake after sleep onset.
Number of Awakenings	Abrupt changes in the EEG frequency, which may include alpha or theta frequencies but not spindles, with a minimal duration greater than 10 seconds.

Table 1. Sleep measures commonly assessed with polysomnography and their operational definitions (continued).

Measure	Operational Definition
Micro-arousals	Abrupt changes in the EEG frequency, which may include alpha or theta frequencies but not spindles, with a minimal duration of 3 seconds and a maximal duration of 10 seconds. A minimal interval of continuous sleep of 10 seconds is necessary to score a second micro-arousal. A micro-arousal index is computed as the number of micro-arousals X 60 minutes / TST.
REM sleep latency (REML)	Time interval between sleep onset and the first epoch of REM sleep.
Rapid eye movement density	Absolute number of rapid eye movements (REM) in REM sleep episode.
REM Sleep Efficiency	Ration of total time asleep in REM sleep / Total in minutes of REM sleep.

Table 1. Sleep measures commonly assessed with polysomnography and their operational definitions (continued).

Measure	Operational Definition
Apnea	Cessation of airflow due to pharyngeal obstruction for at least 10 seconds typically associated with arousals and sleep disruption.
Hypopnea	Reduction of 50% of airflow, associated with arousals and sleep disruption.
Periodic leg movements in sleep	Regular repeating patterns of rhythmical extensions of the big toe and dorsiflexion of the ankle lasting 0.5 to 5 seconds, at intervals of 20 to 40 seconds, and which predominantly occur in NREM sleep. Intense movements can cause arousals and sleep disruption.