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Mediators of Change in Imagery Rescripting and Imaginal Exposure for Nightmares: Evidence From a Randomized Wait-List Controlled Trial

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Imagery rescripting (IR) and imaginal exposure (IE) are two efficacious treatments for nightmare disorder, but their discrete underlying mechanism(s) remain largely unknown. We therefore examined mediators of the treatment effects of IR and IE in a randomized wait-list controlled trial ($N = 104$). Therapeutic outcomes were assessed at pre- and post-assessment, and mediator assessment took place in between treatment sessions to establish a temporal relationship between mediators and nightmare symptoms (i.e., frequency and distress). In line with the hypothesis, enhanced mastery (or self-efficacy) of the nightmare content mediated the therapeutic efficacy of IR. Furthermore, the treatment effects of IE were mediated by increased tolerability of the negative emotions elicited by nightmares. Even though IR and IE for nightmares seem to produce similar therapeutic effects, the results of this study suggest that IR and IE tap into different underlying processes.

Keywords: imagery rescripting; imaginal exposure; nightmares; mediator; mechanism

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NIGHTMARES ARE TYPICALLY DEFINED as extremely dysphoric dreams that involve a threat to an individual's survival, security, or their emotional or physical integrity (American Psychiatric Association [APA], 2013). Due to their concurrence with strong negative emotions such as fear, anger, sadness, and disgust, nightmares are typically well remembered

after awakening (APA, 2013) and cause nightmare sufferers considerable distress (Lancee & Schrijnemaekers, 2013; Nielsen & Levin, 2007; Spoormaker, Schredl, & van den Bout, 2006). Nightmares are relatively common, with up to 83% of adults experiencing one or more nightmare per year (Hublin, Kaprio, Partinen, & Koskenvuo, 1999; Levin, 1994; Schredl, 2010) and 2%–5% having one or more nightmares per week. Such frequent nightmares are more prevalent in psychiatric populations and they are associated with various forms of psychopathology (for reviews, see Nielsen & Levin, 2007; Schredl, 2016; Spoormaker et al., 2006).

Cognitive models of recurrent nightmares suggest that nightmare scripts (the storyline of a recurrent nightmare) are isolated but highly distressing memories, which are poorly integrated into an individual's autobiographical memory due to a lack of contextual information such as time and place (Spoormaker, 2008). Similar to other theories on associative fear memory and anxiety disorders (e.g., Brewin, Gregory, Lipton, & Burgess, 2010; Ehlers & Clark, 2000; Foa & Kozak, 1986), it is assumed that the memory representation of the nightmare is easily activated by neutral or ambiguous dream elements that resemble those of the original dream. In a similar vein, cognitive avoidance or thought suppression of any nightmare-related information in a wakeful state is thought to be a crucial factor in the development and maintenance of recurrent nightmares (Spoormaker, 2008). Cognitive avoidance may (a) prevent the integration of the nightmare script into the autobiographical memory, (b) not allow for fear extinction since the experienced emotion and its intensity will remain unchanged, and (c) prevent spontaneous (or deliberate) changes to the memory of the nightmare script. Consequently, cognitive-behavioral nightmare treatments for chronic nightmares target dysfunctional avoidance processes.

Psychological treatments that are designed to target nightmares typically consist of *imagery rescripting* (IR), *imaginal exposure* (IE), or a combination of the two techniques. Nightmare treatments based on IR and/or IE have already been shown to produce favorable results with regard to nightmare frequency and nightmare distress (for overviews, see Augedal, Hansen, Kronhaug, Harvey, & Pallesen, 2013; Aurora et al., 2010; Hansen, Höfling, Kröner-Borowik, Stangier, & Steil, 2013; Lancee, Spoormaker, Krakow, & van den Bout, 2008; Rousseau & Belleville, 2018). To investigate the efficacy of the isolated treatment components (i.e., IR and IE), we specifically conducted a randomized wait-list (WL) controlled trial (Kunze, Lancee, Morina, Kindt, & Arntz, 2016). Results showed that compared to WL, both IR and IE significantly reduced nightmare frequency ($\Delta d_{\text{IR-WL}} = 0.74$; $\Delta d_{\text{IE-WL}} = 0.70$) and distress ($\Delta d_{\text{IR-WL}} = 0.98$; $\Delta d_{\text{IE-WL}} = 1.35$) from pre- to post-assessment (for details, see Kunze, Arntz, Morina, Kindt, & Lancee, 2017), indicating that IR and IE are effective treatment elements of nightmare therapies (Hansen et al., 2013; Kunze et al., 2017).

With IE, patients are instructed to reexperience distressing nightmares as vividly as possible in their imagination, which typically leads to a reactivation of accompanying emotions. In contrast, IR focuses on changing the content of nightmares into more benign and less distressing mental images, thereby actively reducing negative emotions associated with nightmares. Given that the techniques follow substantially different procedures, it has been proposed that IR and IE may work via different pathways. However, empirical data in support of this notion is currently lacking (Hansen et al., 2013). To eventually enhance the efficacy of the available treatments, it seems worthwhile to further our understanding of the distinct working mechanisms of the different intervention techniques (for a review, see Rousseau & Belleville, 2018). With the present report, we systematically identify and examine a number of variables that might mediate treatment outcome for rescripting- as well as exposure-based nightmare therapies.

Traditional models of exposure therapy (i.e., emotional processing theory; Foa & Kozak, 1986; Foa & McNally, 1996) posit that fear reductions throughout exposure trials (e.g., subjective units of distress; SUD) serve as an index of corrective learning and are necessary to produce long-lasting cognitive and behavioral therapeutic change. Emotional processing theory has long been the prevailing model of exposure therapy for anxiety disorders. However, evidence supporting the role of within- and between-session habituation of subjective and behavioral fear responses as predictors of therapy outcome is currently limited (for a review, see Craske et al., 2008). More contemporary models of exposure therapy place less emphasis on the importance of fear reduction, but rather focus on inhibitory learning as a precursor for therapeutic change. Inhibitory learning models highlight the role of cognitive processes in exposure therapy, with a focus on threat expectancy violation (Craske, Liao, Brown, & Vervliet, 2012; Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014; Hofmann, 2008). Within this framework, corrective learning during exposure should be enhanced if patients encounter a mismatch between expectancy and experience. For example, experiencing the ability to tolerate negative emotions (versus the expectation to not being able to manage negative emotions) can help break through cognitive

and behavioral avoidance processes and stimulates new inhibitory learning (Craske et al., 2014). Tolerability of negative emotions has therefore been proposed to be critical to successful exposure therapy (e.g., Craske et al., 2008).

Rescripting-based therapy is generally thought to change the affective properties of a nightmare by altering its intrinsic meaning. As such, IR may work by influencing the patient's ability to control distressing nightmare images (Germain et al., 2004; Krakow et al., 2001; Long et al., 2011). Enhanced control may be particularly important in nightmare disorder, as dreams that are primarily hallmarked by a lack of self-efficacy are related to more frequent nightmares (Harb, Thompson, Ross, & Cook, 2012) and nightmare sufferers typically experience powerlessness and uncontrollability with regard to their aversive dreams. IR may offer a means to help patients express unmet needs and inhibited responses (Arntz, 2012). The expression of such previously inhibited action tendencies in the new script during IR may therefore (re-)establish a feeling of mastery of the nightmare content (Kunze et al., 2016). In addition, IR may change the meaning of aversive memories through a process called stimulus revaluation (Arntz, 2012). From a fear-learning perspective, this implies that an emotional response (e.g., fear) towards an aversive stimulus (e.g., nightmare) should decrease if the content and subjective evaluation of an unpleasant memory is successfully changed into an emotionally less aversive storyline (Davey, 1997). In other words, IR may directly change the emotional valence of nightmares (Dibbets & Arntz, 2016; Dibbets, Poort, & Arntz, 2012; Hagenaars & Arntz, 2012).

To sum up, in line with traditional models of exposure therapy, we identified (1) SUD toward nightmares as a possible mediator of the treatment effect of IE. Conforming to more contemporary accounts of exposure, we suggest that (2) tolerability of emotions elicited by nightmares might be a critical mediator of the treatment efficacy of IE. Moreover, based on theories about rescripting-based treatments and preliminary empirical findings, we propose that (3) mastery of the nightmare content and (4) nightmare valence may be particularly important mediators of the treatment effect of IR. In addition to these treatment-specific mediators, we identified several other variables that may influence the treatment effects of nightmare therapies in general, which are discussed below.

Upon awakening, recurrent nightmares abruptly evoke strong negative emotions. Such rather unanticipated bursts of emotions have been shown to facilitate the development of anxiety disorders (Barlow, 2002). The significance of perceived uncontrollability and/or unpredictability of potential threat (e.g., negative emotions evoked by nightmares) has been acknowledged in several models of psychopathology (Barlow, 2002; Clark, 1986) and fear-learning theories (Mineka & Zinbarg, 2006; Öhman & Mineka, 2001). Even though the controllability and/or predictability of aversive events has been primarily linked to treatment outcome in exposure therapy (Hofmann, 2008), controllability of emotions may also play an important role in rescripting-based treatments. Next to mastering threat represented in the content of nightmares, it is assumed that IR helps patients to gain control over the emotions they experience in conjunction with nightmares. We therefore argue that the (5) controllability and (6) predictability of emotions elicited by nightmares may play a critical role not only in IE but also in IR (Kunze et al., 2016). Another relevant variable that might mediate nightmare treatment outcome includes (7) the perceived negative consequences of the nightmare, which are hypothesized to be a determining factor for nightmares to become recurrent and problematic (Spoormaker, 2008). In addition, (8) sleep quality is a crucial factor in the (re)consolidation of memories (Stickgold & Walker, 2007) such as recurrent nightmares. For example, Short and colleagues (2017) showed that poor sleep quality was associated with increased PTSD symptoms, which typically include nightmares or other forms of intrusive memories. Higher sleep quality may therefore mediate the efficacy of any nightmare treatment.

With this study, we aimed to identify whether these eight proposed variables are mediators of nightmare treatments, and whether their contribution to treatment efficacy is unique to either IR or IE. For this purpose, we conducted a randomized wait-list (WL) controlled trial, where we first investigated the efficacy of three weekly IR and IE interventions as stand-alone, stripped-down treatments designed to target nightmares (Kunze et al., 2016). Symptom severity was evaluated at pre- and post-assessment (Kunze et al., 2017), and the proposed mediators of the treatment effect were measured in between the treatment sessions (except for SUD ratings, which were measured during treatment). We hypothesized that (1) reduction in SUD and (2) increased tolerability of emotions elicited by nightmares are important mediators of the treatment effect in IE. Further, we expected that (3) improved mastery of the nightmare content and (4) reduced nightmare valence are crucial mediating variables of the treatment effect in IR. In addition, we explored the role of (5) controllability and (6) predictability of emotions elicited by nightmares, (7) negative consequences of nightmares, and (8) sleep quality as

potential mediators of treatment efficacy. To identify whether these mediator variables are unique to either IR or IE, their mediating role was investigated in both treatments (see also Kunze et al., 2016).

Methods

DESIGN AND PARTICIPANTS

Data were collected as part of a randomized-controlled trial, which aimed to investigate the efficacy of IR and IE as individual treatments compared to a wait-list (WL) control condition (Kunze et al., 2017, 2016), and to identify mediators of IR and IE. The study was registered at the Netherlands Trial Register (NTR4951) and the Ethics Review Board of the University of Amsterdam approved the research protocol (2014-CP-3794). Details concerning the study design, participant characteristics, explanation of the interventions, and treatment effects have been reported elsewhere (see Kunze et al., 2017, 2016), and will therefore only be summarized briefly for reasons of clarity.

The total sample consisted of 104 participants with a primary DSM-5 diagnosis of nightmare disorder (APA, 2013), who were randomly allocated to either IR (n = 35) or IE (n = 33), or WL (n = 36). Further inclusion criteria were: one or more idiopathic or posttraumatic nightmare(s) per week, recurrent (emotional) nightmare theme, and sufficient knowledge of the Dutch language. Participants were excluded if they had a current diagnosis of alcohol and/or drug abuse or dependency, PTSD resulting from protracted and recurring trauma (type II trauma), a current diagnosis of psychotic disorder, and CBT-based psychotherapy for nightmare symptoms in the preceding 12 months. If applicable, participants were asked to keep their medication intake stable during and at least 4 weeks before treatment.

INTERVENTIONS

IR and IE treatments entailed three weekly 60-min individual treatment sessions. Irrespective of condition (i.e., IR or IE), each treatment session comprised a brief imagery exercise (4.5 min). Instead of prolonged exposure, the imagery exercise aimed to shortly reactivate the emotions elicited by the nightmare sufficiently in order to address them in treatment (Arntz & Weertman, 1999; Foa & Kozak, 1986) and therapists were specifically instructed not to engage in prolonged exposure. After this brief emotion reactivation, IR or IE took place. In both treatments, participants were instructed to describe their mental images out loud and in as much detail as possible.

IR focused exclusively on rescripting exercises while other treatment components of traditional IRT methods (e.g., Krakow & Zadra, 2006, 2010), such as psychoeducation about nightmares, sleep, or mental imagery, as well as keeping nightmare diaries, and discussing nightmare content, were discarded. Immediately after emotion reactivation, participants were asked to actively change the nightmare scenario in their imagination into a more benign and less distressing storyline and to imagine the new script as vividly and detailed as possible (e.g., Arntz & Weertman, 1999).

IE was similar to traditional prolonged (imaginal) exposure interventions (Foa & Rothbaum, 1989). Treatment components such as psychoeducation, in vivo exposure, emotional processing (Rauch, Eftekhari, & Ruzek, 2012), nightmare diaries, and relaxation exercises (Burgess, Gill, & Marks, 1998; Lancee, Spoormaker, & van den Bout, 2010) were discarded so that IE consisted of imaginal confrontation to the nightmare content only. After reactivation of the accompanying emotions by means of the imagery exercise, participants were asked to imagine the entire nightmare scenario as vividly and detailed as possible.

To assess therapist protocol adherence, audio recordings of treatment sessions were rated by two independent raters using a protocol adherence checklist designed for the present study (see Kunze et al., 2017). High intraclass correlations demonstrated strong absolute agreement between the two raters for all subscales (0.89–0.99). Several independent samples t-tests on the average rating across raters revealed significant differences between the IR and IE treatment on the rescripting and the exposure subscale, indicating high overall treatment fidelity (i.e., therapists did not use rescripting techniques in the exposure group and vice versa).

OUTCOMES

Primary Outcomes

The primary outcome measures were assessed at pre- and post-assessment for all participants, and during each treatment session for participants in the IR and IE condition. In line with previous nightmare research and relevant DSM-5 criteria we employed two primary outcome measures.

Nightmare frequency was measured by the Nightmare Frequency Questionnaire (NFQ; Krakow et al., 2002). This questionnaire consists of two single questions, which assess (a) the number of nights with nightmares in the last week (i.e., nights with nightmares), and (b) the total number of nightmares in the last week (i.e., nightmare frequency). In this study, the latter constituted a primary outcome measure.

Nightmare distress was assessed by means of the Nightmare Distress and Impact Questionnaire

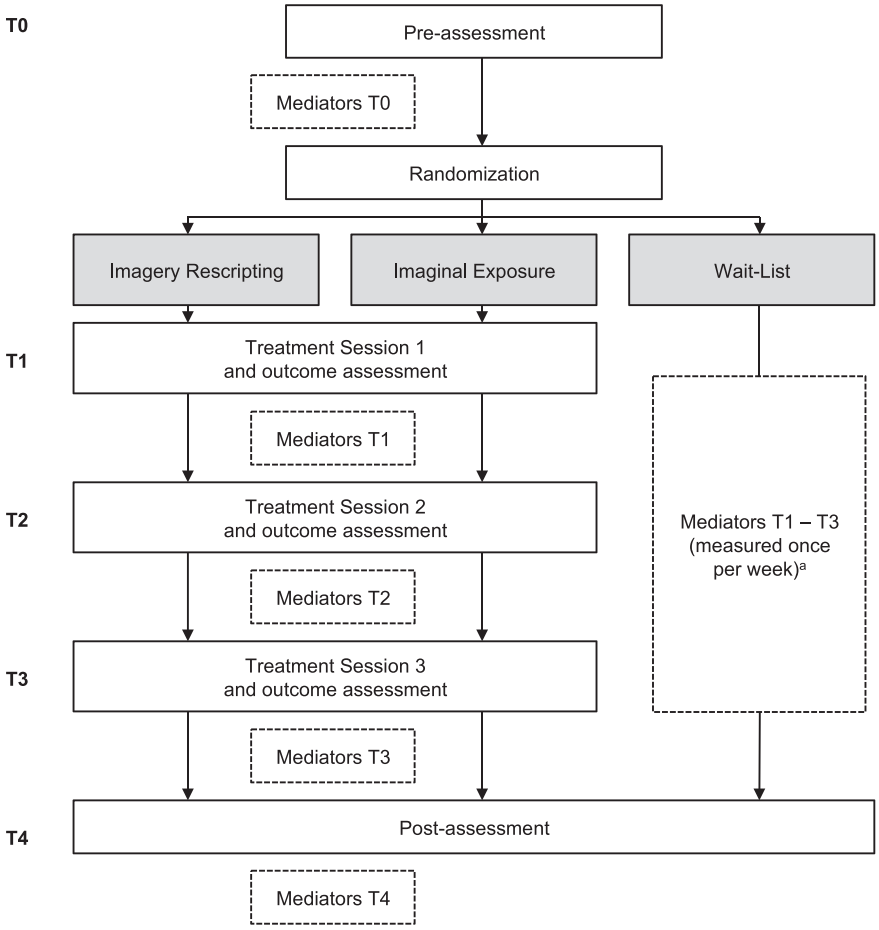

FIGURE 1 Schematic overview of the procedure. T0 = pre-assessment (week 0), T1 = week 1, T2 = week 2, T3 = week 3, T4 = post-assessment (week 4)
[a]SUD could not be measured in the WL condition at T1-T3, as their assessment was part of the imagery exercises embedded in the treatment process. Moreover, outcomes were not assessed during T1-T3 in the WL condition.

(NDIQ), a 12-item questionnaire constructed by the first and second author for the purpose of this study. The NDIQ consists of two subscales, which measure the distress caused by nightmares at night (e.g., "When I awake from a nightmare, I have difficulties going back to sleep") and the impact of nightmares during the day (e.g., "If I have had a nightmare, I feel tired during the day"). Items of the NDIQ are scored on a 4-point scale: 0 (*not*), 1 (*a little bit*), 2 (*somewhat*), and 3 (*completely*) and high scores are indicative of severe nightmare distress. In the present study, the sum score of both subscales served as the second primary outcome measure (range 0 – 36). The NDIQ proved to be a reliable measure in the current sample at pre- and post-assessment (Cronbach's α = .75 and .90, respectively).

Mediators

Potential mediators were assessed by a short online survey. The questionnaire consisted of seven visual analog scales (VAS) ranging from 0 (*not at all* or *very bad*) to 100 (*very much* or *very good*), which measured (1) nightmare valence ("When I think about my nightmares, I get emotional"), (2) predictability of emotions ("I think that I can predict the emotions elicited by my nightmares"), (3) controllability of emotions ("I think that I can control the emotions elicited by my nightmares"), and (4) tolerability of emotions elicited by nightmares ("I think that I can tolerate the emotions elicited by my nightmares"), (5) mastery of the nightmare content ("I think that I am in control of the content of my nightmares"), (6) sleep quality ("How would you evaluate the quality of last night's sleep?"), and (7) negative consequences of nightmares ("Nightmares have a negative influence on my daily functioning"). Note that in Kunze et al. (2016), this variable was labeled "nightmare distress" according to Spoormaker (2008). However, to avoid confusion with the

outcome variable nightmare distress, we renamed this mediator into "negative consequences of nightmares". Between-session (8) subjective levels of distress (SUD; “How distressed do you feel right now?”) were assessed during each treatment session for participants in the IR and IE conditions, and at pre- and post-assessment for all participants. Specifically, participants were asked to indicate their SUD on a scale ranging from 0 (*not at all*) to 10 (*very much*) at the conclusion of the short emotion reactivating imagery exercise at the beginning of each treatment session (see section "Interventions") and during pre- and post-assessment, where the imagery exercise was included to directly assess subjective distress elicited by the nightmare.

PROCEDURE

Participants were recruited through online advertisements and local newspaper announcements. Potential participants were screened for in- and exclusion criteria during a short phone interview and a subsequent face-to-face intake at pre-assessment (T0). In compliance with the Ethics Review Board, written informed consent was obtained from all participants, and they were randomly assigned to one of three conditions: IR, IE, or WL. Participants in the WL condition received IR or IE after the waiting period; however, effects of the treatments in the WL condition after post-assessment were not processed in the current study. One week after pre-assessment, participants in IR and IE received three individual 60-min treatment sessions once per week (T1-T3). After a waiting period of 4 weeks for participants in the WL group, or 1 week after the last treatment session (IR and IE), post-assessment took place (T4). For an overview of the procedure, see Figure 1.

Outcome measures (i.e., nightmare frequency and nightmare distress) were administered at pre- and post-assessment for all participants by means of paper-and-pencil questionnaires. Before each treatment session, outcomes were also measured in the IR and IE condition, but not in the WL condition. Nightmare frequency and distress was also assessed at 3- and 6-months follow-up assessments to determine long-term efficacy of IR and IE (see Kunze et al., 2017). However, for the purpose of the present study, we focused only on data collected within the pre- and post-assessment phase of the trial. Potential mediators of change were assessed weekly for all participants. Specifically, mediators were measured one day after pre- and post-assessments and one day after each treatment session (IR and IE) or once per week for participants in the WL condition.

Dropout occurred in both treatment conditions (n = 2 for both IR and IE), but did not differ between conditions. Furthermore, eight patients (IR n = 4; IE n = 3; WL n = 1) discontinued study participation after randomization, but before they were informed about the outcome of the randomization. Such treatment refusers were excluded from the analysis of treatment outcome (Kunze et al., 2017) and were therefore not included in the present analyses. For a detailed overview of participant flow, see Figure 1 in Kunze et al. (2017).

ANALYSIS

All analyses were carried out using SPSS Version 24 for Mac. Mediation analyses were performed using PROCESS version 2.16 for SPSS (Hayes, 2013).

Mediator Selection

Statistically relevant mediators were selected according to the following steps (see also Kunze et al., 2016).

First, we used linear mixed models to examine change in potential mediator variables. Main effects of Treatment (i.e., IR/IE vs. WL) and Mediator as well as the Mediator × Treatment interaction was evaluated. Also, Pearson’s correlations between the mediators were inspected at each time point to establish the strength of their statistical association and to determine whether forming composite scores of mediators with close theoretical conceptualizations (e.g., mastery of the nightmare content and controllability of emotions elicited by nightmares) was indicated.

Second, separate mixed regression analyses were then conducted to explore the effect of each mediator on both treatment outcomes (i.e., nightmare frequency and nightmare distress) within the active treatment groups (i.e., IE and IR). For this purpose, each mediator score (measured at least one day after pre-assessment and each treatment session) predicted treatment outcome at the following assessment using an unstructured covariance structure for the repeated part of the model, as being the best fitting model for the data. Variables in the mixed regression models included treatment Condition, Time, Mediator, Time × Mediator interaction, as well as relevant covariates (baseline nightmare frequency for nightmare distress analyses and educational level for all analyses; see Kunze et al., 2017). The time variable was coded as one at the baseline assessment and increased by one for each additional assessment. All mediator variables that were a significant predictor of the treatment effect (main effect of Mediator or Time × Mediator interaction) were subsequently selected as variables of interest for the mediation analysis.

Multiple Imputation

Due to the fact that some participants did not always complete online mediator assessments, 14% of the mediator data were missing. To increase the power of the mediation analyses, missing data points were

replaced by multiple imputation (MI) based on the missing at random assumption. For this purpose, we generated 20 imputed datasets (Horton & Lipsitz, 2001; Sterne et al., 2009) for each treatment condition separately (i.e., IR, IE, and WL) to allow for interactions of the imputed variables in the final (mediation) analysis (Graham, 2009; Schafer & Graham, 2002; Schafer & Olsen, 1998; Sterne et al., 2009). Variables in the MI model included the eight proposed mediator variables (i.e., SUDs, tolerability, mastery, nightmare valence, controllability, predictability, negative consequences of nightmares, and sleep quality) and the two outcomes (i.e., nightmare frequency and nightmare distress) at all time points (i.e., T0 through T4). Note that the nightmare frequency distribution was highly skewed and therefore log-transformed before MI. Additional predictor variables in the MI model included educational level, age, and gender of participants.

Mediation Analysis

Simple mediation analyses were also carried out for each statistically relevant mediator on both outcome measures (i.e., nightmare frequency and nightmare distress). To yield the unique indirect effect of X on Y of a specific mediator while at the same time controlling for the effects of other mediators in the model (Hayes & Rockwood, 2017), parallel multiple mediation analyses were also performed for exploratory purposes. Here, all statistically relevant mediators as previously determined were included in a single model for each outcome (Hayes, 2013; Hayes & Rockwood, 2017; Preacher & Hayes, 2008). Conforming to the analyses on treatment outcome (Kunze et al., 2017), separate analyses were conducted for IR and IE (i.e., IR/WL and IE/WL) with WL as reference group (Kraemer, Wilson, Fairburn, & Agras, 2002). Pre-post difference scores (T0 minus T4) of the outcomes served as dependent variable in the mediation analysis. To minimize the temporal overlap between changes in the mediator and changes in the outcome (see Kazdin, 2009), difference scores of mediator assessments (T0 minus T2) were used as predictor variable in the mediation model. While using T0-T1 mediator scores could have further reduced the temporal overlap, inspection of the data suggested that the greatest change occurred after the second treatment session for most mediator variables. Thus, in order to truly capture the effect of IR and IE on the proposed mediator variables while at the same time minimizing possibly overlapping effects with the outcomes, T0-T2 scores seemed most suitable to be used as mediator variable within the present study. For SUD scores, we used pre-post difference scores (T0 minus T4) as mediator given that the imagery exercise, during which SUD was assessed, did not take place in the WL condition at T1, T2, and T3. Due to substantial conceptual overlap, the mediator negative consequences of nightmares was excluded from all subsequent analyses with regard to the outcome nightmare distress and was only used as a predictor of the treatment effects of IR and IE for nightmare frequency. In line with our previous analysis (Kunze et al., 2017), educational level was added to the model as covariate for all analyses, whereas log-transformed nightmare frequency at pre-assessment was added as covariate for nightmare distress analyses only. Analyses were conducted on 20 MI datasets and 50,000 bootstrap samples were generated for each mediation analysis. Test statistics of the individual mediation analyses were summarized by the average of the 20 MI-based analyses (Zhang & Wang, 2013).

Mediation effects were tested by evaluating the average of the upper and lower boundaries of the 95% bias-corrected bootstrap confidence intervals (95% BC CI) of the indirect effect of the 20 MI-based analyses. If not significant based on the 95% BC CI, mediation effects specifically relevant to one of the treatments (i.e., SUD and tolerability for IE, and mastery and valence for IR) were also explored based on the 90% BC CI. Mediation effect size estimates (1 – c'/c) represent the proportion of the effect of the independent variable (i.e., condition) on the dependent variable (i.e., nightmare distress and nightmare frequency) that is accounted for by the mediator (MacKinnon, Fairchild, & Fritz, 2007; but see Lachowicz, Preacher, & Kelley, 2018 for limitations of this approach).

Results

SAMPLE

The final sample consisted of 96 treatment initiators (aged 18 – 77 years, $M = 35.08$, $SD = 14.73$) in IR ($n = 31$), IE ($n = 30$), and WL ($n = 35$). The majority of participants were female (83.3%) and educated at the higher professional and/or university level (82.3%). Participants reported to have had nightmares for 16.90 years on average ($SD = 14.16$), 16.6% were diagnosed with a comorbid Axis I disorder, and 28.1% took medication. Educational level differed significantly across conditions and was therefore controlled for in all relevant analyses. No other differences between the three conditions could be observed for any of the demographic variables. Even though both posttraumatic and idiopathic nightmare sufferers were eligible for participation in the present study, 86.5% ($n = 83$) of the final sample consisted of idiopathic nightmare sufferers.

MEDIATOR SELECTION

Inspection of the data revealed that all mediator variables, except predictability, changed over the course of treatment (for observed descriptive

Table 1
Pooled Imputed Values for All Outcome and Proposed Mediator Variables

	Group	*n*	Pre-assessment (T0)	Week 1 (T1)	Week 2 (T2)	Week 3 (T3)	Post-assessment (T4)
Outcomes, *M* (*SE*)							
Nightmare Frequency	IR	31	5.19 (1.10)	4.65 (1.07)	4.42 (1.09)	3.57 (0.91)	4.01 (1.19)
	IE	30	3.99 (0.64)	3.10 (0.49)	2.95 (0.63)	3.02 (0.62)	2.72 (0.56)
	WL	35	4.00 (0.48)	-	-	-	4.12 (0.54)
Nightmare Distress	IR	31	20.02 (1.09)	17.02 (0.92)	13.84 (1.36)	12.96 (1.47)	13.03 (1.40)
	IE	30	21.33 (0.91)	18.73 (0.94)	14.03 (1.42)	12.13 (1.49)	12.73 (1.36)
	WL	35	19.47 (0.91)	-	-	-	18.06 (1.10)
Mediators, *M* (*SE*)							
Mastery	IR	31	19.74 (4.44)	34.53 (3.88)	43.89 (4.41)	43.34 (4.75)	43.89 (3.99)
	IE	30	11.84 (2.40)	21.53 (3.18)	30.65 (4.30)	34.91 (4.50)	35.03 (3.55)
	WL	35	10.65 (2.89)	19.56 (3.35)	16.70 (2.63)	16.50 (2.15)	17.89 (2.01)
Valence	IR	31	50.42 (4.70)	46.94 (3.79)	41.01 (4.70)	40.47 (4.70)	39.89 (4.08)
	IE	30	48.58 (3.84)	51.50 (4.08)	50.67 (4.21)	33.97 (3.56)	28.90 (3.59)
	WL	35	49.81 (4.70)	51.55 (3.43)	53.76 (4.07)	58.10 (3.64)	56.87 (4.32)
Tolerability	IR	31	56.52 (4.79)	60.79 (3.41)	63.46 (3.92)	63.49 (3.89)	66.50 (2.79)
	IE	30	50.86 (4.21)	53.63 (4.58)	58.92 (3.40)	71.49 (2.63)	72.66 (2.97)
	WL	35	51.52 (4.43)	46.88 (3.87)	41.91 (3.90)	43.41 (3.78)	47.17 (4.08)
SUD	IR	31	6.78 (0.39)	6.81 (0.36)	5.71 (0.38)	5.01 (0.50)	5.01 (0.45)
	IE	30	6.78 (0.38)	7.10 (0.32)	5.86 (0.32)	4.61 (0.35)	4.82 (0.38)
	WL	35	6.65 (0.35)	-	-	-	6.18 (0.47)
Predictability	IR	31	56.29 (4.61)	59.74 (3.58)	66.76 (3.90)	66.64 (2.57)	58.56 (3.42)
	IE	30	52.82 (4.22)	60.27 (4.55)	58.18 (4.20)	58.54 (4.84)	60.68 (3.91)
	WL	35	62.74 (3.25)	58.70 (3.49)	56.38 (3.22)	62.45 (2.73)	61.34 (3.11)
Controllability	IR	31	48.32 (4.93)	51.79 (4.11)	64.53 (3.87)	59.64 (3.85)	62.21 (2.59)
	IE	30	47.52 (4.49)	45.83 (4.81)	51.56 (4.41)	61.04 (3.75)	64.94 (3.62)
	WL	35	50.92 (4.60)	40.80 (3.68)	42.87 (3.90)	46.51 (3.55)	44.65 (3.83)
Negative consequences	IR	31	55.97 (4.27)	54.50 (3.80)	52.28 (3.97)	50.28 (3.84)	42.91 (3.84)
	IE	30	58.59 (4.15)	54.53 (4.15)	56.55 (3.97)	48.01 (3.98)	43.16 (3.60)
	WL	35	49.94 (4.80)	51.26 (3.92)	53.90 (3.78)	59.70 (4.17)	60.77 (3.68)
Sleep quality	IR	31	40.68 (3.09)	44.98 (3.79)	56.72 (3.07)	49.33 (4.19)	55.43 (3.52)
	IE	30	43.16 (4.33)	43.45 (4.90)	55.62 (4.72)	56.35 (4.93)	53.92 (4.40)
	WL	35	42.36 (4.10)	40.55 (3.26)	44.07 (3.72)	42.99 (4.08)	44.68 (3.67)

Note. Controllability = "I think that I can control the emotions elicited by my nightmares."; IE = imaginal exposure; IR = imagery rescripting; Mastery = "I think that I am in control of the content of my nightmares."; Negative consequences = "Nightmares have a negative influence on my daily functioning."; Predictability = "I think that I can predict the emotions elicited by my nightmares."; Sleep quality = "How would you evaluate the quality of last night's sleep?"; SUD = Subjective Unit of Distress, "How distressed do you feel right now?"; Tolerability = "I think that I can tolerate the emotions elicited by my nightmares."; Valence = "When I think about my nightmares, I get emotional."; WL = wait-list

statistics, see Supplementary Material Table A). Predictability was therefore excluded as a potential mediator of the treatment effects of IR and IE from the following analyses. Correlations between any of the mediators were considered too small to group mediators into theoretically meaningful composite scores at any time point (T0 = rs < .600, T1 = rs < .668, T2 = rs < .542, T3 = rs < .691, T4 = rs < .676; for an overview of correlations among mediators for each time point, see Supplementary Material Table B-F).

Mixed regression analyses showed that mastery of the nightmare content (b = -0.08, SE = 0.02, t = -3.45, p = .001), controllability of emotions (b = -0.05, SE = 0.01, t = -5.02, p < .001), and tolerability of emotions (b = -0.05, SE = 0.02, t = -2.72, p = .007) were significant predictors of the treatment effect on nightmare distress independently of treatment condition. Regardless of treatment condition, these variables were therefore identified as possibly relevant mediators of the treatment effect on nightmare distress. Nightmare valence, sleep quality, and SUD ratings (or their interaction with time) did not significantly predict treatment outcome.

For nightmare frequency, mastery of the nightmare content (b = -0.01, SE < 0.01, t = -2.19, p = .030), tolerability of emotions (b = -0.01, SE < 0.01, t = -2.27, p = .024), SUD ratings (b = 0.05, SE = 0.03, t = 1.96, p = .051), and negative consequences of nightmares (b = 0.01, SE < 0.01, t = 2.16, p = .032) were (near) significant predictors of the treatment effect (all main effects). These variables were selected as possibly relevant mediators of the treatment effect on nightmare frequency

Table 2
Single Mediation Analyses Based on Imputed Values

Condition	Dependent Variable	Mediator (M)	Effect of IV on M (a) *b* (SE), *t*	Effect of M on DV (b) *b* (SE), *t*	Indirect effect (ab) *b* [95% BC CI]	Direct effect (c') *b* (SE), *t*	Total effect (c) *b* (SE), *t*
IR vs. WL							
	Nightmare Distress	Mastery	-8.62 (2.06), -4.18***	-0.13 (0.05), -2.66*	**1.08 [0.42, 2.20]**	1.31 (0.87), 1.49	2.40 (0.81), 2.97**
		Tolerability	-8.21 (3.71), -2.21*	-0.05 (0.03), -1.87	**0.42 [0.05, 1.08]**	1.98 (0.82), 2.41*	2.40 (0.81), 2.97**
		Controllability	-11.48 (3.82), -3.02**	-0.01 (0.04), -0.29	0.13 [-0.50, 0.72]	2.35 (0.87), 2.65*	2.40 (0.81), 2.97**
	Nightmare Frequency	Mastery	-8.48 (2.12), -4.00***	-0.03 (0.02), -1.34	**0.28 [-0.01, 0.70]**[a]	0.38 (0.44), 0.88	0.64 (0.40), 1.66 ($p = .14$)
		Tolerability	-8.26 (3.68), -2.24*	0.01 (0.01), 0.35	-0.04 [-0.26, 0.14]	0.68 (0.42), 1.68	0.64 (0.40), 1.66 ($p = .14$)
		SUD	0.71 (0.31), 2.21*	0.10 (0.16), 0.60	0.07 [-0.13, 0.55]	0.65 (0.40), 1.36	0.64 (0.40), 1.66 ($p = .14$)
		Neg. consequ.	1.37 (3.07), 0.45	0.00 (0.02), -0.08	0.00 [-0.11, 0.12]	0.65 (0.40), 1.65	0.64 (0.40), 1.66 ($p = .14$)
IE vs. WL							
	Nightmare Distress	Mastery	-13.04 (4.29), -3.04**	0.01 (0.05), 0.27	-0.17 [-1.69, 1.38]	7.34 (1.73), 4.26***	7.17 (1.60), 4.48***
		Tolerability	-17.67 (6.11), -2.89**	-0.08 (0.03), -2.61*	**1.48 [0.31, 3.22]**	5.69 (1.63), 3.49**	7.17 (1.60), 4.48***
		Controllability	-12.10 (7.46), -1.62	-0.07 (0.03), -2.57*	0.82 [-0.10, 2.72]	6.35 (1.57), 4.06***	7.17 (1.60), 4.48***
	Nightmare Frequency	Mastery	-12.96 (4.25), -3.07**	-0.03 (0.02), -1.32	0.37 [-0.07, 1.29]	1.02 (0.77), 1.36	1.39 (0.72), 1.92 ($p = .07$)
		Tolerability	-17.69 (6.06), -2.92***	-0.02 (0.02), -1.33	**0.41 [-0.03, 1.10]**[b]	1.00 (0.76), 1.27	1.39 (0.72), 1.92 ($p = .07$)
		SUD	1.52 (0.65), 2.33*	-0.31 (0.14), -2.28*	**-0.47 [-1.38, -0.05]**	1.86 (0.73), 2.56*	1.39 (0.72), 1.92 ($p = .07$)
		Neg. consequ.	5.93 (6.74), 0.88	0.01 (0.01), 0.20	0.02 [-0.17, 0.38]	1.37 (0.73), 1.88	1.39 (0.72), 1.92 ($p = .07$)

Note. a = effect of group on mediator; b = effect of mediator on outcome; BC CI = Bootstrap-corrected confidence interval (based on 50,000 samples); c = total effect of group on outcome (without the influence of the mediator in the model); c' = effect of group on outcome when controlled for the mediator; DV = dependent variable; IE = imaginal exposure; IR = imagery rescripting; IV = independent variable; M = mediator; WL = wait-list. Significant indirect effects relevant for the interpretation of the results are marked bold.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

[a] $b = 0.27$, 90% BC CI [0.04, 0.64]

[b] $b = 0.38$, 90% BC CI [0.03, 0.96]

(regardless of condition). Nightmare valence, sleep quality, and controllability of emotions (or their interaction with time) did not significantly predict treatment outcome (see Supplementary Material Table G and H for results of the mixed regression analyses).

MEDIATION ANALYSES

Mediation analyses were based on data obtained through MI (for imputed descriptive statistics, see Table 1). Results of the single mediation analyses are reported in Table 2.

Nightmare Distress

In line with the hypotheses, single mediation analyses indicated that change in mastery of the nightmare content significantly mediated the treatment effect of IR and explained 50% of the total effect (see Figure 2A), whereas it did not mediate the efficacy of IE (5%; see Figure 2B). Moreover, change in tolerability of emotions was a significant mediator of the treatment effect of IE and explained 22% of the total effect (see Figure 2D), but unexpectedly also of IR (19%; see Figure 2C). Contrary to the expectations, change in controllability of emotions did not mediate the treatment effects of IR or IE. Parallel multiple mediation analyses largely supported these findings and further showed that, if controlled for the other mediators in the model, the indirect effect for change in tolerability in IR does not persist (see Supplementary Material Table J). In congruence with the single mediation analyses, multiple mediation analyses revealed that change in controllability of emotions and sleep quality did not mediate the treatment effects of IR or IE.

Nightmare Frequency

Single mediation analyses showed that change in mastery of the nightmare content mediated the treatment effect of IR (based on a 90% BC CI [0.04, 0.64]) and explained 47% of the total effect, whereas it did not mediate the efficacy of IE (29%). Also, change in SUD ratings significantly mediated the treatment effect of IE, but not of IR. Note that due to a suppressor effect, the direct effect (c') of IE on nightmare frequency increased after including the mediator into the model (see Table 2). Last, change in tolerability of emotions mediated the effect of IE (based on a 90% BC CI [0.03, 0.96]) and explained 34% of the total effect, while it did not mediate the efficacy of IR (-1%). Single mediation analyses further showed that change in negative consequences of nightmares did not mediate the treatment effects of IR or IE. Once more, the findings were supported by results of the parallel multiple mediation analyses, which showed that change in mastery of the nightmare content was a significant mediator of the efficacy of IR (based on a 90% BC CI [0.03, 0.75]), but not of IE. Change in tolerability of emotions did not significantly mediate the efficacy of IE based on a 95% BC CI, but the 90% BC CI [-0.01, 0.93] closely approached zero. In contrast, tolerability was not a mediator of the treatment effect of IR. Change in SUD ratings significantly mediated the efficacy of IE, but not of IR. Lastly, change in negative consequences of nightmares did not mediate the effects of IR or IE on nightmare frequency.

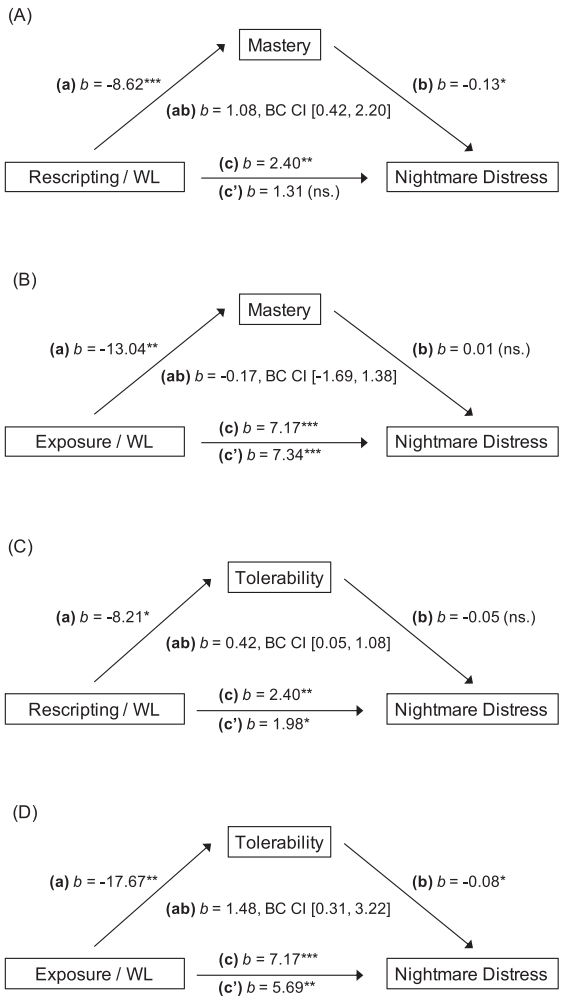

FIGURE 2 Graphical representation of the single mediation effects for mastery for IR (A) and IE (B) and for tolerability for IR (C) and IE (D) on nightmare distress. a = effect of group on mediator; b = effect of mediator on outcome; c = total effect of group on outcome (without the influence of the mediators in the model); c' = effect of group on outcome when controlled for the mediator; BC CI = lower and upper level of 95% bootstrap-corrected confidence interval (based on 50,000 samples)
*$p < .05$, **$p < .01$, ***$p < .001$

Discussion

This study examined mediators of the treatment effects of IR and IE, two efficacious therapeutic methods for recurrent nightmares. The methodological features of our study design allowed us to establish temporal relationships between the hypothesized working mechanisms of IR and IE in relation to change in nightmare symptoms over the course of treatment. While both therapies produced comparable treatment effects from pre- to post-assessment (Kunze et al., 2017), the present results indicate that IR and IE may tap into different underlying processes.

MEDIATORS OF CHANGE IN IMAGERY RESCRIPTING

With regard to the proposed mediators of IR, we observed that change in mastery of the nightmare content significantly mediated the treatment efficacy of IR on nightmare distress and nightmare frequency. This mediation effect was exclusive to IR, as mastery did not mediate the efficacy of IE. In line with the hypothesis (Kunze et al., 2016), our data support the proposition that IR works through increasing a sense of mastery in nightmare sufferers (e.g., Germain et al., 2004; Krakow et al., 2001; Long et al., 2011), which then leads to a reduction of nightmare symptoms. These results may stimulate research into how IR should be employed most effectively. For example, it is generally agreed that patients' sense of mastery (or self-efficacy) increases if they play an active role in the rescripting process of the negative image, for example, by disempowering a perpetrator (e.g., Smucker, Dancu, Foa, & Niederee, 1995). However, some patients are not always able to effectively rescript a distressing memory by themselves, either because they do not know what a healthier and more benign script would look like, or because they do not feel capable to intervene or change the image. In these cases, mastery may be exercised by assigning trustworthy helpers (such as the therapist) to the image who may assist patients to fulfill their unmet needs, while the patients themselves play a more passive role in the rescripting process and/or the resulting rescripted storyline (e.g., Arntz & Weertman, 1999). On this note it was shown that perceiving other responsible persons as in control of the situation might help to reduce experienced discomfort (Brewin & Bradley, 1982). Whether these variations of IR have differential effects on mastery and/or on treatment outcome remains an empirical question. Nonetheless, the present data offer preliminary evidence that mastery should be addressed in treatment to increase the efficacy of IR.

Contrary to the expectations, mixed regression results indicated that nightmare valence did not have a predictive effect on either nightmare frequency or nightmare distress. Whereas this may be due to a lack of sensitivity with respect to the item that was used to measure nightmare valence, the explanation seems unlikely in light of the fact that valence ratings decreased over the course of treatment (see Table 1). Alternatively, it should be considered that IR does not work via changing nightmare valence, but that a shift in the emotionality of nightmares actually represents a treatment outcome. Even though we did not find evidence for a decrease in emotional valence of nightmares as a mechanism of IR, we argue that increased mastery of the nightmare content (versus powerless and helplessness) was indicative of successful stimulus devaluation (e.g., Davey, 1997). Thus, the present results support the proposition that IR works by devaluating the stimulus content, while the question whether IR may directly change the emotional valence of unpleasant memories warrants further investigation. In order to study evaluative memory processes underlying psychological therapies, experimental models of psychopathology are often used. With respect to the underlying processes of IR, it may be worthwhile to further investigate the stimulus devaluation hypothesis by means of purpose-built fear-conditioning paradigms (e.g., Dibbets et al., 2012; Kunze, Arntz, & Kindt, 2015), which can be utilized to examine memory processes underlying psychological treatments including exposure therapy and IR.

Unexpectedly, single mediation analysis showed that change in tolerability mediated the efficacy of IR on nightmare distress (but not nightmare frequency), indicating that increased tolerability of emotions may be involved in the process of IR. However, parallel multiple mediation analysis revealed a non-significant mediation effect for tolerability in IR, if controlled for all other mediators in the model. Given that it is implausible to assume that the effects of IR or IE could be accounted for by a single variable, it seems likely that separate mediators may operate simultaneously. While the present data offer preliminary insights into the working mechanisms of rescripting-based interventions by identifying mediator variables of interest, additional research is clearly needed to examine additional variables that might be involved in the treatment process of IR.

MEDIATORS OF CHANGE IN IMAGINAL EXPOSURE

Concerning mediators of the treatment effect of IE, we found that change in tolerability mediated

treatment efficacy on nightmare distress and nightmare frequency. The results are in line with modern accounts of exposure therapy, which state that increasing patients' ability to tolerate fear may be critical for treatment outcome (Craske et al., 2014), as the tolerability of negative emotions such as fear may promote the formation of new inhibitory associations (Arch & Craske, 2011). In support of this proposition, it was shown that thought suppression in waking states leads to increased dreaming of the suppressed content (Schmidt & Gendolla, 2008; Taylor & Bryant, 2007; Wegner, Wenzlaff, & Kozak, 2004) and increased subjective dream distress (Kröner-Borowik et al., 2013). Thus, it seems plausible that increased toleration of aversive emotions elicited by nightmares leads to a reduction of nightmare symptoms.

Interestingly, we also observed that change in SUD ratings toward the nightmare during the imagery exercise at pre- and post-assessment mediated the treatment effect of IE on nightmare frequency. However, the effect did not point in the expected direction. While receiving IE led to significantly larger change scores in SUD (i.e., more reduction) than WL, stronger reductions in SUD co-varied with smaller change scores in nightmare frequency (i.e., less reduction). In other words, between-session habituation toward nightmares was inversely related to therapy outcome. In line with contemporary accounts of exposure therapy, this may imply that the concept of fear reduction stands in contrast to the notion of fear toleration in exposure therapy (Craske et al., 2008, 2014). Even though the present data do not allow for inferences about the importance of emotion reduction versus toleration in exposure therapy or their causal relationship, our data may fuel the discussion about the relevance of within- and between-session reductions of fear in exposure treatment outcome. Yet, it should be mentioned that a temporal relationship between SUD ratings and nightmare frequency could not be assumed (Kazdin, 2007), as the mediator was measured simultaneously with the outcomes (i.e., at pre- and post-assessment).

MEDIATORS OF CHANGE IN NIGHTMARE TREATMENTS IN GENERAL

Next to treatment-specific mediators, we also explored other variables potentially relevant in the therapeutic process. Specifically, predictability of emotions elicited by nightmares did not respond to treatment (IR or IE) and was therefore excluded from all further analyses. Possibly, the concept "predictability of emotions" may have been too difficult to grasp and the formulation of this item may not be suited to assess such a complex conceptualization. Controllability of emotions elicited by nightmares was statistically identified as a potential mediator of the treatment effects of IR and IE on nightmare distress. However, mediation analyses revealed that controllability did not mediate the treatment effects of either IR or IE. While it could be argued that controllability of emotions is simply not a mediating variable of nightmare treatments, it is also possible that the operationalization of the variable was flawed. Specifically, there may be some theoretical overlap with the concept "tolerability" of emotions, as indicated by the highest correlations among variables at all measurement points (see Supplementary Material Tables B-F). Patients may have had difficulties to comprehend the differences between these concepts and we cannot be certain that the items were interpreted exactly as we intended them to. Thus, due to methodological weaknesses in the operationalization of these variables, definite inferences about their mediating role in nightmare treatments cannot be made. We therefore suggest that predictability, controllability, and tolerability of emotions should be measured more carefully in future studies, and the conceptual differences between variables should more clearly be defined.

Nightmare distress (i.e., negative consequences of nightmares) did not mediate the treatment efficacy of either IR or IE. We suggest that this may at least partially be due to the fact that nightmare distress is not yet clearly defined in the nightmare literature. For example, nightmare distress may comprise the emotional intensity of the nightmare (e.g., Lancee et al., 2010), as well as negative appraisals about nightmares (Spoormaker, 2008). In addition, nightmare distress can also be conceptualized in terms of nightmare effects, usually defined as the impact of nightmares on social functioning (Krakow et al., 2000). Lastly, nightmare distress can be demarcated as nightmare-related symptoms, which include more persistent psychological and sleep-related consequences of nightmares (e.g., Davis & Wright, 2007). In the present study, we operationalized the mediator distress caused by nightmares in terms of the negative daytime consequences of nightmares. Unfortunately, this item only covers a small aspect of a currently very broad theoretical construct, and it remains unclear whether it encloses the most important aspect of this construct. Recent efforts to advance our understanding of nightmare distress should be continued (e.g., Böckermann, Gieselmann, & Pietrowsky, 2014; Martínez, Miró, & Arriaza, 2005) to establish a unified definition of nightmare distress in nightmare research.

In many sleep disorders patients report poor quality of sleep. However, sleep is known to play an

important role in the therapeutic process of most psychological treatments (Stickgold & Walker, 2007) and it therefore seems plausible that increased sleep quality may be an important variable in the treatment process of sleep-related symptoms such as nightmares. Yet, sleep quality was not a significant predictor of treatment efficacy over time regardless of treatment condition. In light of the fact that IR and IE were implemented as stripped-down treatments, it bears mentioning that the treatments were not designed to directly influence sleep quality. Additionally, self-rated sleep quality often does not converge with objectively measured sleep quality in patients with sleep disturbances (Harvey & Tang, 2012). We therefore cannot rule out the possibility that sleep quality may play a mediating role in the therapeutic process when it is directly addressed in treatment, or when measured more objectively (e.g., by means of polysomnography or actigraphy).

LIMITATIONS

In addition to the issues discussed above, the study had a number of methodological limitations that should be mentioned. First, there is an ongoing discussion about how to model change in statistical mediation analysis (see Valente & MacKinnon, 2017) and there are several limitations to the use of change scores (Hayes & Rockwood, 2017). To establish a temporal relationship between mediator and outcome (e.g., changes in the mediator occur before changes in the outcome), assessment of the variables should overlap as little as possible (Kazdin, 2007, 2009). To this end, we used T0-T2 change scores as mediators (except for SUDs, where T0-T4 was used) and T0-T4 outcome scores in the present study. While we realize that this design does not entirely preclude the possibility that the outcomes may have improved before the putative mediator variables (Kazdin, 2007), in light of the relatively small sample size, we decided to use change scores as they reduce between-subjects variance. Second, raw change scores are limited in that they are unconditional on pretest scores (Valente & MacKinnon, 2017). Exploratory mediation analyses using residualized change scores on the completers sample showed no significant mediation for any of the relevant variables (i.e., mastery and tolerability), indicating that initial mediator scores may influence subsequent changes in the mediator and its effect on treatment outcome. Future research should take individual differences into account when investigating underlying mechanisms of psychological treatment. Third, we initially aimed to assess mediators the day (i.e., one night) after each treatment session (Kunze et al., 2016) to directly capture the effects of IR, IE, or WL on the mediator variables and to minimize the influence of any confounding variables. However, this was not always feasible and participants often filled out the mediator assessments a few days later. Given that the time lapse between the variables used in the present study (i.e., T2 vs. T4) still allows for the insinuation of a temporal relationship between mediator and outcome, we argue that minor temporal variability in mediator assessments (i.e., a few days) does not compromise the interpretability of the data. Fourth, relatively small effect sizes of the proposed mediators on the total effect (particularly in IE) indicated that other relevant processes or variables were possibly overlooked. Fifth, we acknowledge that a lack of validation may reduce confidence in the NDIQ as primary outcome measure. However, given that its construction was essentially based on two validated nightmare distress questionnaires, i.e. Nightmare Distress Questionnaire (Belicki, 1992) and Nightmare Effects Survey (Krakow et al., 2000), the NDIQ has high face validity and we presume that it constitutes a valid measure (Kunze et al., 2017, 2016). Sixth, mediators were assessed by means of single-item measures, which limits inferences about their reliability and/or validity. Seventh, due to the restricted power of the mediation analyses, mediator variables that did not change over the course of treatment should not stringently be ruled out as possible mechanisms of change. Last, in light of the fact that the study was not powered to detect differences between the two active treatments, we did not compare the therapeutic effects of IR and IE or their proposed mediators directly. Additional studies with sufficient sample sizes are needed to examine whether the identified working mechanisms are truly unique to the different treatment techniques.

Conclusions

This study aimed to systematically investigate mediators of the treatment efficacy of rescripting- and exposure-based nightmare therapies. Exposure therapy and its underlying processes seem to be generally well-understood (i.e., inhibitory learning; Bouton, 2004; Craske et al., 2012; Hofmann, 2008) and our results suggest that current theories about mediators of exposure treatments might generalize to IE for nightmares (i.e., increased emotion toleration). In contrast, the working mechanisms of rescripting treatments to date remain largely unknown (Arntz, 2012). The present study, therefore, provides invaluable though preliminary evidence for the mediating role of mastery in rescripting-based therapies of aversive memories

such as nightmares. Given that IR has beneficial effects on a variety of disorders ranging from anxiety disorders and posttraumatic stress disorder (Morina, Lancee, & Arntz, 2017) to personality disorders (Arntz, 2012; Holmes, Arntz, & Smucker, 2007), our results add to a better understanding of the therapeutic mechanisms of rescripting-based treatment in general. Well-powered studies are needed to further identify and examine mediators in rescripting-based therapies and to inform us about possible mechanisms of change.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.beth.2019.03.003.

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