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Treatment of PTSD: A comparison of imaginal exposure with and without imagery rescripting ☆

Arnoud Arntz*, Meike Tiesema, Merel Kindt[1]

Department of Clinical Psychological Science, University of Maastricht, P.O. Box 616, NL-6200 MD Maastricht, The Netherlands

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Abstract

We tested whether the effectiveness of imaginal exposure (IE) treatment for posttraumatic stress disorder (PTSD) was enhanced by combining IE with imagery rescripting (IE + IR). It was hypothesized that IE + IR would be more effective than IE by (1) providing more corrective information so that more trauma-related problems can be addressed, and (2) allowing patients to express emotions that they had been inhibiting, such as anger. In a controlled study 71 chronic PTSD patients were randomly assigned to IE or IE + IR. Data of 67 patients were available. Treatment consisted of 10 weekly individual therapy sessions and treatment evaluation was conducted post-treatment and at 1-month follow-up. Results show that when compared with wait-list, treatment reduced severity of PTSD symptoms. More patients dropped out of IE than out of IE + IR before the 8th sessions, 51% vs. 25%, $p = .03$. Completers and intention-to-treat analyses indicated that both conditions did not differ significantly in reduction of PTSD severity. IE + IR was more effective for anger control, externalization of anger, hostility and guilt, especially at follow-up. Less strong effects were found on shame and internalized anger. Therapists tended to favor IE + IR as it decreased their feelings of helplessness compared to IE. Results suggest that the addition of rescripting to IE makes

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*Corresponding author.
E-mail address: Arnoud.Arntz@MP.unimaas.nl (A. Arntz).
[1]Now at the Department of Clinical Psychology, University of Amsterdam, The Netherlands.

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the treatment more acceptable for both patients and therapists, and leads to better effects on non-fear problems like anger and guilt.

Keywords: PTSD; Imagery rescripting; CBT; RCT; Clinical trial

1. Introduction

Among treatments for posttraumatic stress disorder (PTSD) exposure therapy has until now been most extensively studied and proved to have strong empirical support for its effectiveness (Bradley, Greene, Russ, Dutra, & Westen, 2005; DeRubeis & Crits-Cristoph, 1998; van Etten & Taylor, 1998; Seidler & Wagner, 2006). In direct comparisons, systematic imaginal exposure (IE) to memories of traumatic stimuli, either alone or in combination with exposure *in vivo*, has been proved to be superior to wait-list (WL) or other treatment conditions like stress inoculation training (Foa et al., 1999), eye movement desensitization and reprocessing (Renfrey & Spates, 1994), or non-trauma focused treatments (Schnurr et al., 2007). Meta-analyses indicated comparable effectiveness for exposure treatment alone, exposure combined with cognitive restructuring, EMDR, and cognitive treatments (Bradley et al., 2005; van Etten & Taylor, 1998; Seidler & Wagner, 2006).

In IE patients are asked to recall the details of the traumatic event while focusing their attention on any occurring sensory feelings, thoughts, and emotions. Exposure to such memories results in reduction of fear and avoidance. The presumed underlying mechanism is the loosening of the association between unconditioned and conditioned stimuli (cf. Foa et al., 1999; Foa, Rothbaum, Riggs, & Murdock, 1991).

An alternative explanatory mechanism for the success of IE in treating PTSD is provided by information-processing theory (Foa & Kozak, 1986). Information-processing theory offers a model of the process by which stimulus information, response information and meanings of these stimuli and responses, are stored in fear networks. These fear networks are viewed as programs that stimulate avoidance of trauma-related stimuli (Foa & Kozak, 1986; Foa, Steketee, and Rothbaum, 1989). Foa et al. (1989) propose that two conditions are necessary for the accomplishment of fear reduction. The fear memory must be activated, and new information that is incompatible with the current fear structure must be provided.

This raises the question whether IE is the most optimal procedure to both *activate traumatic memories* and to *provide corrective information*. Indeed some authors criticize IE that it only reduces fear, leaving other emotions and cognitions that often accompany PTSD (i.e. feelings of guilt, shame or disrupted self-image) unchanged (Frueh, Turner, Beidel, Mirabella, & Jones, 1996; Grey, Holmes, & Brewin, 2001; Grey, Young, & Holmes, 2002; Grunert, Weis, Smucker, & Christianson, 2007; Holmes, Grey, & Young, 2005; Pitman et al., 1991; Smucker, Dancu, Foa, & Niederee, 1995). Several methods have therefore been suggested to enhance the effectiveness of IE, e.g. trauma management therapy (Frueh et al., 1996), cognitive processing therapy (Resick & Schnicke, 1992), the addition of cognitive restructuring (Bryant, Moulds, Guthrie, Dang, & Nixon, 2003; Grey et al., 2002; Marks, Lovell, Noshirvani, Livanou, & Thrasher, 1998), and imagery rescripting (IR) (Arntz & Weertman, 1999; Smucker et al., 1995). Note however that even if IE reduces only fear in a direct way, other emotions and cognitions might change as the trauma memory becomes less fragmented and more coherent. For example, following IE,

patients might judge themselves on the whole memory rather than on a particular fragment, which may lead to a reduction of guilt.[2]

Until recently, the discussion about PTSD treatment has focused mainly on how the traumatic memories may be optimally activated and on the question of how corrective information can best be provided to the patient. Issues concerning responses (i.e., behavioral and verbal action) however have hardly been addressed. During traumatic experiences expressive responses (e.g. aggression) are often inhibited for reasons of survival (Nijenhuis, Spinhoven, Vanderlinden, Van Dyck, & Van der Hart, 1998). This is consistent with the finding of Holmes et al. (2005) that one of the most common themes reported during trauma hotspots was cognitions about control over the traumatic situation (e.g. fighting back, making an escape, etc.), often where taking control was not possible. It is conceivable that this inhibition leads to learned helplessness and a disrupted self and worldview.

IR was developed as a method not only to activate the traumatic memory and to provide corrective information to a wide range of issues, but also to provide the patient with an opportunity to discover and express any trauma-related inhibited emotional responses. IR was hypothesized to alleviate PTSD symptomatology as well as change trauma-related beliefs and schemas (e.g. powerlessness, victimization, and inherent badness). The method implies changing the traumatic imagery to correct the situation in fantasy, and to produce a more favorable outcome (without denying the trauma), imagining having control over the situation and being able to act according to one's needs, to express one's feelings and action tendencies. For instance, anger about what happened is expressed, which leads to the replacement of feelings of victimization by the feeling of mastery. Thus, in IR expression of inhibited responses is facilitated as well as new information is provided during evocation of the traumatic memory (Arntz & Weertman, 1999; Smucker et al., 1995). IR procedures can be applied alone or in combination with other therapeutic procedures, such as IE; although IR inevitably involves some IE.

There are various versions of IR. The version tested in the present study focused on emotions, impulses and needs experienced by the patient during imaginal reliving of the trauma. When these were clear to the patient, the patient was stimulated to express them in fantasy in the image. This often leads not only to (imagined) expression of inhibited emotions and actions, but also to new viewpoints bringing about a change in meaning of the traumatic event. The type of IR we investigated differs from other forms of IR or verbal cognitive techniques, in that it is more an experiential technique (i.e., using the experienced emotions and action tendencies of the patient as a starting point) than a cognitive technique (usually taking thoughts and interpretations, and especially biases in them, as a starting point). In contrast to verbal techniques, it uses perceptual modes, based on the idea that perceptually encoded memories are prominent and problematic in PTSD, and the successful treatment of PTSD should lead to a transformation of perceptually encoded memories to conceptual memories (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Kindt, Buck, Arntz, & Soeter, 2007).

We hypothesized that IE, when combined with IR, leads to superior treatment outcome compared to IE alone because of the following reasons. Firstly, as IE + IR provides more corrective information than IE a broader range of trauma-related problems can be addressed. Secondly, imaginal expression of inhibited responses breaks through patterns of helplessness, victimization, numbing and passivity. We therefore tested whether the

[2]Thanks are due to anonymous reviewer for pointing out this possibility.

addition of rescripting to IE would lead to a broader improvement than IE alone, notably in the areas of hostile complaints, anger expression, anger control, guilt and shame. Note that the opposite could also be true: the free expression of anger in fantasy (e.g., killing a perpetrator in fantasy) could lead to a disinhibition of aggression, thus to an increase of anger problems, which in turn might lead to increased guilt and shame. For this reasons, many therapists feel insecure when they stimulate patients to express anger, especially patients who already have problems with anger control. The same may hold for other emotions and needs, for instance dependency needs in small children, which patients may experience and satisfy in fantasy when they rescript their childhood traumas.

Treating PTSD patients with IE might be a stressful task for therapists (see van Minnen & Keijsers, 2000, for an overview of the literature). The therapist has to guide the patient through imaginal relieving of the trauma, empathically listening to the patient telling the trauma in here-and-now terms, while staying relatively passive during the exposure. During IE, therapists are confronted repeatedly with very aversive information, which may evoke emotional and behavioral responses they cannot express. This might induce high levels of powerlessness and stress in the therapist. Although it has been reported that such experiences do not lead to gross malfunctioning of CBT therapists (van Minnen & Keijsers, 2000), adding rescripting might still help not only the patient but also the therapist to better endure the traumas the patient is reliving. We therefore also investigated the preferences for IE or IE + IR of our therapists, and their reasons for possible preferences.

The present study was designed as a randomized treatment trial. Male and female victims of sexual assault, non-sexual assault and other trauma, with chronic PTSD, were treated in one of two conditions (IE or IE + IR). Active treatment was also compared to a WL group. Three hypotheses were tested: (i) active treatment is superior to WL in reducing overall PTSD severity, (ii) IE + IR is superior to IE in reducing PTSD symptomatology, and (iii) IE + IR is superior to IE in reducing PTSD-related problems (i.e. internally and externally directed anger, control over anger, guilt, and shame). Finally, we assessed the preferences of the therapists, and the reasons for their preferences.

2. Method

2.1. Participants

Participants were patients from the regular stream of patients at the Community Mental Health Center of Maastricht who met the criteria for PTSD based on either the third revised edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III-R*; American Psychiatric Association, 1987) or later on the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; American Psychiatric Association, 1994) as their primary diagnosis. No restrictions were made with regard to the nature of the index trauma(s), nor were childhood traumas excluded. The index traumas of the 67 patients who started treatment were divided as follows: 23 patients were victims of non-sexual assault (e.g., physical abuse, assault with a weapon), 20 were victims of sexual assault (i.e. rape or attempted rape), and 24 were victims of other traumatic experiences (i.e. accidents or witnessing trauma of others). Time since the index trauma ranged from 4 months to 48 years with a median of 24 months (interquartile range 12–48). Sixty-one percent had experienced single trauma, 39% had experienced multiple traumas. Seventy-six percent of the participants reported trauma(s) that had taken place in

adulthood, and 24% reported trauma(s) had taken place in childhood before age 16. Of the single index traumas, three were from childhood, 38 from adulthood. Of the multiple traumas 13 were from childhood and 13 from adulthood.

Eligibility for the study was determined in the initial evaluation, which included the Dutch version of either the Structured Clinical Interview for *DSM-III-R* (SCID; Spitzer, Williams, Gibbon, & First, 1989; Koster van Groos, 1985) or the Structured Clinical Interview for *DSM-IV* disorders (First, Spitzer, Gibbon, & Williams, 1996; Van Groenestijn, Akkerhuis, Kupka, Schneider, & Nolen, 1999). Inclusion criteria were: primary diagnosis of PTSD of at least 3 months duration, asking for treatment of the PTSD symptoms and being older than 17 and younger than 75 years. Exclusion criteria were psychotic disorder in present or past, mental retardation, alcohol or drug dependence, current assault or threats, instability of primal sources (i.e. having no income or no place to live), no social support at all, and having received behavioral therapy for PTSD symptoms prior to this study. When not derived from SCID or other formal test (e.g., IQ test), exclusion criteria were assessed by open clinical interview and subsequent discussion in the mental health center's intake staff. The institute's ethical committee approved the study. All patients gave informed consent.

Patient flow is illustrated in Fig. 1. Twelve participants were diagnosed with PTSD during initial evaluations but did not enter the study. One declined research participation. Five met one of the exclusion criteria (i.e., PTSD not the primary diagnosis [2], refugee with no Dutch citizenship nor housing permit [1], current assault [1], not wanting treatment of PTSD because of a financial claim [1]). Two claimed at the start of therapy to have improved so much during wait-list that they did not need treatment anymore. The remaining 4 signed consent forms but did not respond to our attempts to contact them at start of treatment. Another four patients refused the condition they were randomized to (3 IE, 1 IE + RS). We analyzed data from the 67 patients who started the treatment condition they were allocated to. Substantial numbers of patients were lost to post-treatment assessments, especially in the IE condition (Fig. 1). Most treatment drop-outs refused further assessments.

The final sample consisted of 23 men and 44 women, aging from 17 to 72 ($M = 35$; $SD = 12$). Compared to the general Dutch population the average educational level was low. Fifteen (22.4%) had no more than primary school education, another 15 (22.4%) the lowest level of secondary education (levels range 1–4), 10 (14.9%) the second secondary educational level, 15 (22.4%) the third secondary school level, and 12 (17.9%) the highest level of secondary education or a higher level of occupational training. None of the participants had finished university. Only 8 participants had a full-time job, another 14 a part-time job, and 12 were students. Others were either housewife (8), on sick-leave (7), receiving disability compensation (14), retired (1), unemployed (1), or had an unknown financial situation (2). Self-reported duration of PTSD at screening ranged from 4 to 588 months, with a mean of 47 (SD 89) and a median of 18 months.

2.2. Measures

2.2.1. Interview measures

Structured Clinical Interview for the DSM-III-R/IV Axis-I (SCID): The SCID (Spitzer et al., 1989; Koster van Groos, 1985) is a semi-structured interview designed to assess major Axis I disorders. In the present study, it was administered only at pretreatment. The DSM-IV version (First et al., 1996; Van Groenestijn et al., 1999) was used when it became available.

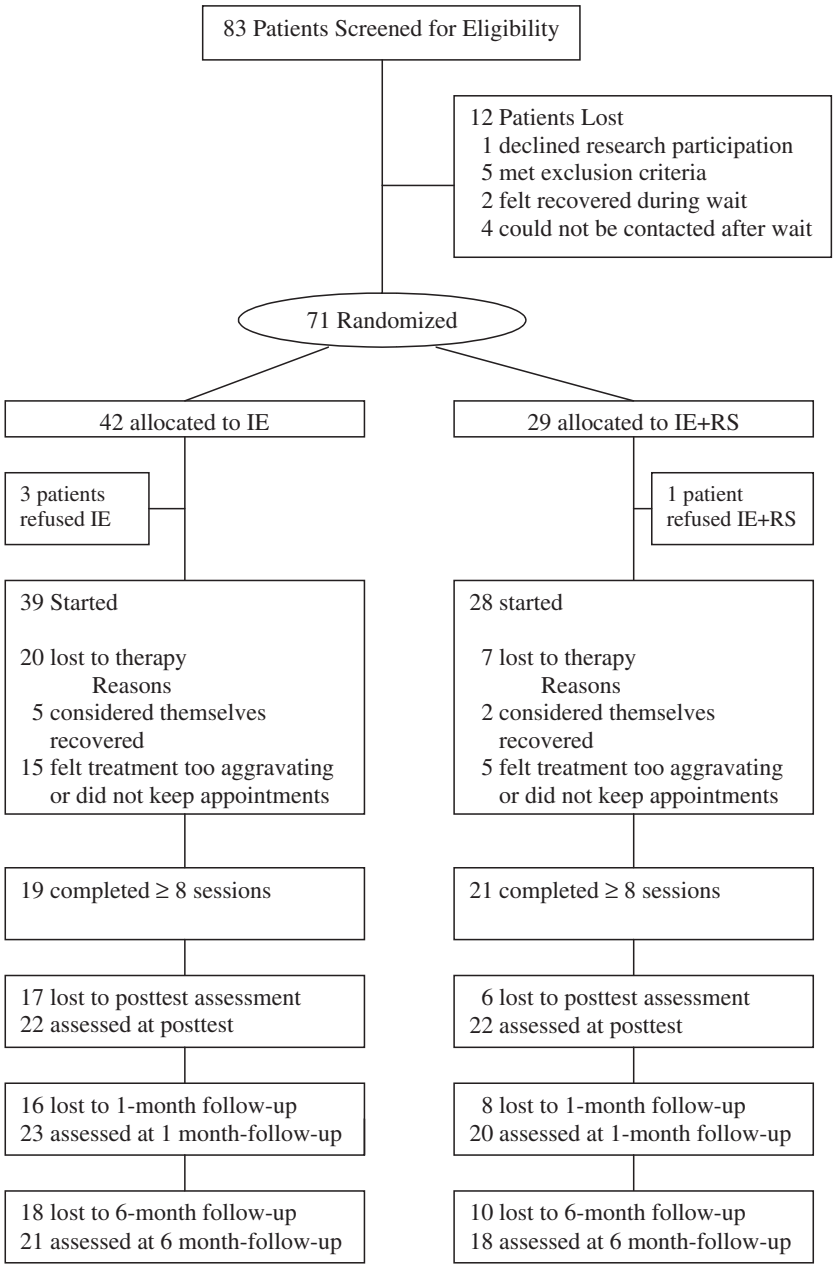

Fig. 1. Flow-chart of the participants.

2.2.2. *Self-report measures*

PTSD Symptom Scale-Self-rating (*PSS-SR*): The Dutch version of the PSS-SR (Foa, Riggs, Dancu, & Rothbaum, 1993; Arntz, 1993) contains 17 questions that correspond to the *DSM-IV* PTSD symptoms, each rated on a 0–3 point scale for frequency or severity,

depending on the item. The PSS yields one sum score of the 17 questions. Psychometric properties of the Dutch PSS are reported by Engelhard, Arntz, and van den Hout (2007). In the present sample internal consistency of the PTSD symptom scale was .88. Two questions were added to measure feelings of guilt and shame. (During last week, how often did you feel very guilty about the traumatic event? During last week, how often did you feel very ashamed about the traumatic event? With 0 = never; 1 = sometimes; 2 = often; 3 = very often-always.) These additional questions were not used for computation of total PSS score.

Fear Questionnaire (*FQ*): The FQ (Marks & Matthews, 1979) consists of two sections, one concerning anxiety and one concerning avoidance in particular situations. Open items (i.e. the main phobia scale) were used to measure both anxiety and avoidance of what participants claim to be their primary fear. The idiosyncratic formulation of the participants' primary fear was done by patient and therapist in collaboration, before randomization. Good psychometric properties of the FQ phobia scales have been reported (Arrindel, Emmelkamp, & Van Der Ende, 1984; Marks & Matthews, 1979; Van Zuuren, 1988), but properties of FQ main phobia scales are seldom reported. In the present WL group, test–retest reliability of the main phobia items was excellent (avoidance, .96; anxiety, .90).

Anger Expression Scale (*AEX*): The AES (Knight, Chisholm, Paulin, & Waal-Manning, 1991) consists of three subscales measuring the extent to which feelings of anger are held within (Anger In, 8 items), expressed towards others (Anger Out, 8 items), and controlled (Control Anger In, 4 items and Control Anger Out, 4 items). Questions are rated on a scale ranging from 1 to 4. Reliability ranges from .73 to .84.

Zelfexpressie en -controle vragenlijst (*ZECV*) (*Self-expression and Self-control Questionnaire*): The ZECV (Maes, Van Elderen, van der Ploeg, & Spielberger, 1987) consists of 4 subscales measuring internalization of anger, externalization of anger and experienced control over each. All subscales consist of 10 items each and can be scored on a 1–4 rating scale. Factorial validity of the ZECV is excellent (Maes et al., 1987). In our sample the internal consistencies of the subscales were excellent: internalization of anger, .90; externalization of anger, .92; control over internalized anger, .87; control over externalized anger, .91.

Hostility Subscale of Symptom Checklist-90 (*SCL-90*): The hostility subscale of the SCL-90 (Arrindel & Ettema, 1986) was used as index of symptoms of hostility. Patients are asked to indicate the intensity of symptoms as they experienced them during the past week on a 5-points scale. Reliability of the subscale was .84 in a sample of psychiatric outpatients.

Expectancy of therapeutic outcome: Therapeutic expectation (Borkovec & Mathews, 1988; Devilly & Borkovec, 2000) was measured by rating the answers of the following three questions on a 9-points scale: 'How logical does the proposed treatment seem to you?', 'How much confidence do you have that the proposed treatment will help you resolve your problems?', and 'To what extent would you recommend this treatment to your best friend if he/she was experiencing similar problems?'

2.3. Procedure

2.3.1. Evaluations and design

Patients were interviewed using an open interview format as well as the SCID (First et al., 1996; Koster Van Groos, 1985; Spitzer et al., 1989; Van Groenestijn et al., 1999).

Those who met criteria for the study and signed consent forms were randomly assigned to one of two treatment conditions: IE or imaginal exposure with IR (IE + IR). Randomization was unstratified. To keep completers cell sizes in balance, patients dropping out before the 8th session were replaced by the next patient waiting for treatment. Twenty-one participants were enrolled onto a WL condition, before they were assigned to treatment condition.

Assessments were conducted at pretreatment, post-treatment and at 1- and 6-months follow-ups. All measures except for the SCID-I were administered at each assessment point. The PSS-SR was administered at the beginning of each therapy session. The questionnaire concerning expectation of treatment outcome was given to the patient at the end of the first session, with the instruction to fill it in at home and return it within a week in a sealed envelope to the research assistant (and not to the therapist) to ensure confidentiality of the ratings.

2.3.2. Treatment

Treatment was given on an individual basis by 4 male and 7 female cognitive behavioral therapists. Therapists were trained in the protocols by the second author. They met on a weekly basis to discuss their patients and receive supervision (by A.A.). Treatment consisted of nine weekly sessions of IE, preceded by an introductory session. In this 60-min introductory session patients were educated on the nature and development of PTSD symptoms and given extensive information about the treatment procedure and treatment rationale. Nine weekly 90-min sessions of exposure therapy with or without rescripting followed. For research purposes, exposure *in vivo* was not part of the treatments. A PSS-SR was administered at the beginning of each session.

IE: IE was based on the program designed by Foa & Rothbaum (1989). After reviewing homework, 60 min of imagery exposure were conducted by asking patients to close their eyes and recall the details of the traumatic event while focusing their attention on any occurring feelings, thoughts, and actions. They were instructed to recount the memory of the traumatic event using present tense as if the event was happening here and now. During exposure the patient was supported by the therapist and encouraged to focus on details of the traumatic event, dwelling on or 'rewind and hold' an image of an aspect of the trauma that evoked a high level of anxiety. The memory of the trauma was repeated if necessary to allow a total exposure of 60 min. Asking the patient to rate the emotions experienced on a Subjective Units of Distress Scale (SUD Scale, range 0–100) every 5 min monitored the patient's distress level during exposure. In the course of the treatment patients were encouraged to focus on memories of details of the traumatic event(s) that elicited more intense emotions, i.e. resulted in higher scores on the SUD Scale. At the end of each session difficulties, changes and emotions were discussed, patients were supported, and therapists reinforced patients' efforts to IE. Each exposure session was audiotaped and patients were instructed to listen to the 1-h audiotape 5 days of the week. Standard Homework Diary Forms were used by patients to rate their level of emotions before, during and after each exposure at home. Patients' homework was reviewed at the beginning of each session.

IE+IR: The first three sessions of exposure plus IR were the same as the sessions of exposure without IR. In the fourth exposure session therapists and patients worked together to discover any reaction(s) the patients wished to have shown at time of the

trauma, but had not done because at the time these reactions either had not been possible or had failed to be expressed effectively. In session 5–9 patients were asked while being exposed to the most difficult moments of the traumatic event, to imagine reacting as they wished they had done. If they did not like this imagined new response, therapist and patient worked together to find new responses. The patient tried these in imagination until a satisfying response, according to the patient's judgement, was imagined and could be used repetitively in imagery. Therapists checked whether patients engaged in guilt-inducing reasoning by hindsight, e.g. started to blame themselves for not having been more aggressive to defend themselves. When this was the case, they discussed with the patients that at the time there were good reasons for not knowing what to do or not engaging in actions that could have been life-threatening. But, no formal cognitive therapy was used for this. It was further stressed that it was healthy to not longer inhibit but to act out these tendencies in fantasy. Like IE sessions, IE + IR sessions had a 90 min duration with 60 min spent on imagery work (IE or IE + IR).

WL: Due to naturalistic fluctuations in patient flow and treatment capacity, waiting time before treatment started increased during certain periods to about 3 months. During such periods a WL group was created. Participants who were recruited for the WL were informed that they would be able to start treatment in 10–15 weeks. This time period was chosen to equal WL and treatment period as much as possible.

2.4. Statistical analysis

Since two anger direction/control instruments were included, we constructed composite scores on the basis of the results of a factor analysis (PCA with direct oblimin rotation). Three factors were derived (eigenvalue >1) on which the following scales were based: (i) anger-control, consisting of the mean item score of the anger-control subscales of the AES and the ZECV; (ii) anger in: internalization of anger, consisting of the mean item score of the anger-in subscales of the AES and the ZECV and (iii) anger out: externalization of anger, consisting of the mean item score of the anger-out subscales of the AES and the ZECV.

Between condition effects were analyzed by means of repeated measures ANOVA with Greenhouse–Geisser corrected degrees of freedom when indicated. When outliers, non-normal distributions and heteroscedascity violated assumptions of parametric analysis, robust ANCOVA with a bootstrap technique to estimate significance levels was applied (Wilcox, 2006, 2007). This method estimates the difference between conditions with a percentile bootstrap method, conditional on the covariate. We used $n = 2000$ bootstrap samples. Robust methods have better power when assumptions of parametric methods are violated, but parametric methods have optimal power when assumptions are met. Within-condition effect sizes were expressed as Cohen's d, with pooled standard deviations of the assessments, and between condition effect sizes as η^2. For robust ANCOVA we estimated between condition effect sizes by calculating Cohen's d from z derived from the estimated p-level. Because of missing values, d.f. varies slightly. The WL group was compared to the combined IE and IE + IR participants who did not had to wait. After testing WL versus treatment, the WL subjects were added to the treatment group to test the difference between IE and IE + IR.

As the focus was primarily at comparing the effects of IE + IR with IE alone, we first analyzed the data of the patients that completed at least 8 sessions (completers analysis).

As many of the patients received additional treatment after the 1-month follow-up for clinical reasons (either directed on PTSD or on other problems), we only analyzed the pretest, posttest and 1-month follow-up data with repeated measures ANOVA. The 6-months follow-up results are only descriptively presented.

Intention-to-treat analyses used all the data available, and where data were not available, we used the last observation carried forward to impute lost data. This conservative procedure seemed more valid than mixed-modeling approaches as drop-out turned out to be non-random: associated both with less response (on the PSS change score: $F(1, 63) = 6.45$, $p = .014$, $\eta^2 = .09$) and with condition on other measures (see Results). For the PSS, weekly assessments were available during the treatment period, so that for later assessments that were not available, the PSS score obtained just before the last session was used.

End-state functioning (recovery). Good end-state functioning was defined by Foa et al. (1999) as being at or below a score of 20 on the primary outcome measure PSS-SR, as suggested in the manual for the self-report version of the PSS-I (Foa, 1995). We took this cut-off score as a proxy for recovery from PTSD. χ^2 tests and logistic regression were used to test between condition effects on proportions of participants that reached this criterion.

3. Results

3.1. Wait-list versus treatment

3.1.1. Equivalence of conditions

Twenty-one participants were assigned to a WL, leaving $N = 52$ for the treatment condition. Five of 21 WL-participants (31%) dropped out during the waiting period, but one could be assessed, leaving 17 participants for the posttest of the WL condition. Reasons for dropout were subjective decrease of PTSD symptoms (1), pregnancy in combination with holiday (1), reluctance to recall traumatic memories (1), and not responding to invitation by the therapist (2). Participants in the WL condition did not differ significantly from participants in the treatment condition in demographics. Participants of both conditions did not differ in type of trauma (sexual assault, non-sexual assault and others), and severity or duration of PTSD-symptoms.

3.1.2. Treatment vs. WL in reducing PTSD symptoms

Means and standard deviations for PSS total score of the completer sample in the WL condition ($N = 17$) were 26.94 ($SD = 12.83$) at pretest and 27.47 ($SD = 12.16$) at posttest (within-condition change $d = -.04$, n.s.) compared to 27.20 ($SD = 10.50$) and 16.20 ($SD = 12.76$) in the treatment condition ($N = 30$; within-condition reduction $d = .94$, $p < .001$). A repeated measures ANOVA yielded a significant treatment by time interaction, $F(1,45) = 11.50$, $p = .001$, $\eta^2 = .20$. When intention-to-treat treatment data were compared to WL data, treatment still had a significant effect above wait, $F(1,67) = 7.15$, $p < .01$, $\eta^2 = .10$. The treatment group ($N = 52$) had a reduction from mean = 26.54 ($SD = 10.42$) to mean = 18.96 ($SD = 12.97$), within condition $d = 0.64$, $p < .001$. In conclusion, treatment proved to be more effective than WL.

3.2. IE versus IE+IR

3.2.1. Treatment groups at baseline

Table 1 gives an overview of patients' characteristics in both conditions at baseline. None of the variables differed significantly between treatment groups. The treatment groups had similar levels of PTSD duration, although in the IE + IR group there were two cases with very long duration (34 and 48 yr). There was a trend towards a difference between conditions in PSS score, with the IE + IR condition tending to be more severe, $t(65) = 1.67$, $p = .10$. But, in the completers sample the conditions were more equivalent in this respect, $t(38) = .63$, $p = .53$.

3.2.2. Treatment attrition

As is clear from Fig. 1, 3 patients refused to start IE and 1 patient refused to start IE + IR treatment. These 4 patients reported that after hearing the treatment rationale they did not dare to start therapy. Of the sample that actually started treatment, more patients dropped out of treatment before the 8th session in the IE condition (51%) than in the IE + IR condition (25%), χ^2 (1, $N = 67$) = 4.68, $p = .031$. On the average, IE + IR patients received more sessions than IE patients, $t(62.38) = 2.14$, $p = .036$.

3.2.3. Treatment expectation

There was no significant difference between conditions in the average of the treatment expectation items, $z = .96$, $p = .34$, Mann–Whitney test. The three separate items were also not significantly different between conditions. The average expectations were fairly high, IE: 7.01 (*SD* 1.21) and IE + IR: 6.75 (*SD* 1.19) on a 1–9 scale. Treatment completers did not differ from treatment drop-outs in expectation, $z = -1.06$, $p = .30$, Mann–Whitney test.

3.2.4. Completers analysis

Table 2 presents means, standard deviations, and effect sizes (Cohen's *d*) of within-condition changes with respect to pretest.

3.2.4.1. PTSD symptoms. A repeated measures analysis on PSS scores in the completers sample revealed that there was a strong effect of time, $F(1.46, 55.36) = 23.06$, $p < .001$, $\eta^2 = .38$. Both the linear and the quadratic trends were significant, $F(1,38) = 24.22$, $p < .001$, $\eta^2 = .39$; $F(1,38) = 21.14$, $p < .001$, $\eta^2 = .36$. The condition × time interaction was n.s., $F(1.46, 55.36) = 0.10$, $p = .85$, $\eta^2 = .003$. Table 1 shows that there was a steep decline in PTSD symptoms at posttest, which was maintained at 1-month follow-up. At posttest, the recovery rates in the completers sample were 63% (IE) and 62% (IE + RS), χ^2 (1, $N = 40$) = .19, $p = .66$. At follow-ups these figures were 58% and 56% (IE), and 48% and 69% (IE + RS), χ^2's $< .54$, p's $> .45$.

3.2.4.2. Main phobia. A repeated measures analysis on the mean fear and avoidance main phobia scores revealed a strong effect of time, $F(1.36, 42.15) = 20.63$, $p < .001$, $\eta^2 = .39$. The linear trend indicated a strong reduction of main phobia scores, $F(1,33) = 25.55$, $p < .001$, $\eta^2 = .44$; the quadratic trend a leveling off at first follow-up, $F(1,33) = 10.36$, $p = .003$, $\eta^2 = .24$. There was no condition by time effect, $F(1.28, 42.15) = .037$, $p = .90$, $\eta^2 = .001$.

Table 1
Baseline characteristics of the 67 study participants

	IE ($n = 39$)	IE + IR ($n = 28$)	Test statistic	p-value
Age (M (SD))	35.41 (12.73)	35.29 (11.29)	$t = -.04$	.97
Women (n (%)	27 (69.2)	17 (60.7)	$\chi^2 = .52$	.47
Education (1–6; M (SD))	3.08 (1.37)	2.68 (1.54)	$t = -1.12$	.27
Employment status (n (%))[a]				
Full time work	5 (13.2)	3 (11.1)	$\chi^2 = .06$	.81
Part time work	7 (18.4)	7 (25.9)	$\chi^2 = .53$	.47
Student	6 (15.8)	6 (22.2)	$\chi^2 = .43$	.51
Illness compensation	13 (34.2)	8 (29.6)	$\chi^2 = .51$	.70
Most recent work level[b]				
Manual labour (yes; n (%))	18 (47.4)	12 (42.9)	$\chi^2 = .13$	.72
Level (1–6; M (SD))	2.82 (1.63)	2.82 (1.68)	$t = .01$	.99
Marital status				
Married/cohabitating (n (%))	22 (56.4)	16 (57.1)	$\chi^2 = .004$	.95
PTSD duration (Months, m.d. (quartiles 1–3))[c]	18 (12–48)	24 (12–68)	$z = .81$	.42
Previous treatment(s) (yes, n (%)[b]	13 (33.3)	6 (22.2)	$\chi^2 = .96$	.33
Medication (yes, n (%))	15 (38.5)	11 (39.3)	$\chi^2 = .005$	.95
PSS pretest (M (SD))	25.03 (10.88)	29.39 (10.17)	$t = 1.67$	.10
Time since index trauma (Months, m.d. (quartiles 1–3))[c]	24 (12–48)	27 (13–57)	$z = .83$	.41
Index trauma type				
Nonsexual assault (n (%))	17 (43.6)	6 (21.4)		
Sexual assault (n (%))	11 (28.2)	9 (32.1)	$\chi^2 = 3.93$	.14
Others (n (%))	11 (28.2)	13 (46.4)		
Single index trauma (vs. multiple) n (%)	21 (53.8)	20 (71.4)	$\chi^2 = 2.12$	.15
Childhood index trauma (vs. adult) n (%)	10 (25.6)	6 (21.4)	$\chi^2 = .16$	.69
Single index trauma in childhood (vs. adulthood) n (%)[d]	1 (4.8)	2 (10.0)	$\chi^2 = .41$	.52
Multiple index trauma in childhood (vs. adulthood) n (%)[e]	9 (50.0)	4 (50.0)	$\chi^2 = .0$	1.00

[a]Data of two participants are missing.
[b]Data of one participant is missing.
[c]Mann–Whitney test.
[d]Percentage within each condition of the single index trauma subsample.
[e]Percentage within each condition of the multiple index trauma subsample.

3.2.4.3. Anger control. A repeated measures ANOVA revealed a main effect of time, $F(1.85, 61.16) = 4.77$, $p = .014$, $\eta^2 = .126$, and a significant interaction between condition and time, $F(1.85, 61.16) = 6.89$, $p = .003$, $\eta^2 = .173$. The linear trend was significantly

Table 2
Means, standard deviations, and effect sizes for change compared to baseline for treatment completers

	Pretreatment		Posttreatment			1 month follow-up			6 months follow-up[a]		
	M	SD	*M*	SD	*d*	*M*	SD	*d*	*M*	SD	*d*
PSS-SR											
IE	27.53	10.04	17.63	13.76	.80	18.16	14.97	.76	17.56	14.46	.80
IE + IR	29.62	10.86	18.52	14.50	.89	20.43	12.70	.75	17.56	13.88	.97
Main phobia											
IE	6.76	1.58	5.13	2.29	.87	4.61	2.56	1.11	4.17	2.27	1.34
IE + IR	6.57	1.24	4.85	2.21	.91	4.42	2.10	1.11	4.59	2.39	1.03
Anger control											
IE	.67	.12	.69	.14	.13	.65	.13	−.14	.72	.13	.35
IE + IR	.65	.17	.74	.16	.61	.74	.16	.61	.72	.15	.49
Anger in											
IE	.44	.22	.46	.20	−.09	.41	.22	.13	.40	.20	.17
IE + IR	.56	.22	.46	.27	.44	.46	.23	.45	.45	.28	.47
Anger out											
IE	.29	.13	.26	.13	.24	.30	.13	−.08	.27	.12	.16
IE + IR	.30	.13	.27	.12	.24	.25	.11	.40	.27	.12	.24
SCL90 hostility											
IE	10.32	5.06	9.31	4.64	.19	10.56	5.86	−.04	8.81	3.83	.32
IE + IR	13.05	6.38	10.20	5.10	.53	10.05	4.94	.54	8.82	3.17	.89
Guilt											
IE	.53	.61	.74	.81	−.25	.79	.86	−.29	.84	.96	−.33
IE + IR	1.33	1.07	.52	.81	.96	.81	.98	.58	.71	1.01	.67
Shame											
IE	.58	.90	.63	.76	−.06	.74	.93	−.17	.53	.77	.06
IE + IR	.95	.97	.57	.87	.43	.62	.92	.35	.81	.98	.15

Note: Cohen's *d* computed for the within condition change with respect to pretest, with the pooled pretest and assessment point SD's of both conditions. Positive *d*'s denote improvement, negative *d*'s worsening.

[a]Note that many patients received additional treatment between 1-month and 6-month follow-up. The 6-month follow-up data cannot be interpreted as condition effects and are presented only for descriptive purposes.

different between conditions, with the IE + IR condition having a steeper increase in anger control, $F(1,33) = 10.88$, $p = .002$, $\eta^2 = .25$. The quadratic trends didn't differ significantly, $p = .85$. At posttest IE + IR was superior to IE in growth in anger control, $F(1,33) = 5.07$, $p = .031$, $\eta^2 = .133$. The same held at 1-month follow-up, $F(1,33) = 10.88$, $p = .002$, $\eta^2 = .25$.

3.2.4.4. Anger in. The reduction in this anger factor tended to be larger in the IE + IR condition (Table 2). Robust ANCOVA indicated that at posttest IE + IR was superior to IE in reduction of Anger In scores, $p = .028$, equivalent $d = .66$. At 1-month follow-up, the condition effect failed to reach significance, $p = .90$, $d = .04$.

3.2.4.5. Anger out. Robust ANCOVA's indicated that at posttest the conditions did not differ, $p = .46$. But at 1-month follow-up, reduction of anger was stronger in the IE + IR condition than in the IE condition, $p = .043$, equivalent $d = .62$.

3.2.4.6. Hostility. Robust ANCOVA's indicated that the reduction in SCL-90 hostility scores did not differ between conditions at posttest, $p = .73$, $d = .10$; but at first follow-up IE + IR was superior to IE, $p = .045$, $d = .61$.

3.2.4.7. Guilt. A repeated measures ANOVA revealed a significant interaction between condition and time, $F(1.82, 69.08;$ GG correction$) = 7.55$, $p = .002$, $\eta^2 = .17$. The reduction in guilt ratings was significantly stronger in the IE + IR condition (Table 2), as indicated by the difference in linear and quadratic trends, $F(1,38) = 6.03$, $p = .019$, $\eta^2 = .14$; $F(1,38) = 8.71$, $p = .005$, $\eta^2 = .19$. At both posttest and 1-month follow-up, the condition by time interaction was significant, $F(1,38) = 10.84$, $p = .002$, $\eta^2 = .222$; and $F(1,38) = 6.03$, $p = .019$, $\eta^2 = .137$.

3.2.4.8. Shame. Robust ANCOVA's revealed that there was a trend at posttest that the reduction in shame was stronger in IE + IR compared to IE, $p = .066$, equivalent $d = .55$; and that IE + IR was superior to IE at first follow-up, $p = .037$, equivalent $d = .64$.

3.2.5. Intention-to-treat analysis

Table 3 gives an overview of means, standard deviations and within-condition effect sizes of changes with respect to pretest.

3.2.5.1. PTSD symptoms. A repeated measures analysis on the three assessments yielded a main effect of time, indicating a strong reduction of symptoms, $F(1.36, 88.31) = 25.58$, $p < .001$, $\eta^2 = .28$. The conditions did not differ in time course of PTSD symptoms, $F(1.36, 88.31) = 0.41$, $p = .58$, $\eta^2 = .006$. At posttest, the recovery rates in the ITT sample were 59% (IE) and 54% (IE + RS), χ^2 $(1, N = 67) = .19$, $p = .66$. At first follow-up, the rates were 54% (IE) and 43% (IE + RS), χ^2 $(1, N = 67) = .79$, $p = .38$. At second follow-up, the rates were 56% (IE) and 46% (IE + RS). As at baseline the IE + IR condition tended to have more severe PSS scores, the analyses of recovery rates were repeated using logistic regression with pretest PSS scores and condition as covariates. These analyses indicated no effects of condition, posttest Wald = .18, $p = .67$, OR = 1.28 (95% CI [.41, 4.00]); first follow-up Wald = 0, $p = .98$, OR = .99 (95% CI [.32, 3.10]); second follow-up Wald = .011, $p = .92$, OR = .94 (95% CI [.32, 2.79]). The pretest PSS score was strongly related to a smaller chance to recover, posttest Wald = 12.28, $p < .001$, OR = .89 (95% CI [.83, .95]); first follow-up Wald = 13.09, $p < .001$, OR = .88 (95% CI [.83, .95]); second follow-up Wald = 9.57, $p = .002$, OR = .91 (95% CI [.86, .97]). The logistic regressions indicate that the slight differences in recovery rates between conditions were entirely attributable to pretest differences.

3.2.5.2. Main phobia. There was a strong time effect, indicating reduction of main phobia ratings, $F(1.92, 124.46) = 22.57$, $p < .001$, $\eta^2 = .24$; but the condition by time interaction failed to reach significance, $F(1.92, 124.46) = .45$, $p = .63$, $\eta^2 = .009$.

Table 3
Means, standard deviations, and effect sizes for change compared to baseline for the intention-to-treat sample

	Pre-treatment		Post-treatment			1 month follow-up			6 months follow-up[a]		
	M	SD	*M*	SD	*d*	*M*	SD	*d*	*M*	SD	*d*
PSS-SR											
IE	25.03	10.88	18.28	13.25	0.56	18.97	13.93	0.51	17.34	13.47	0.65
IE + IR	29.39	10.17	20.54	13.62	0.73	21.93	12.02	0.63	22.29	12.74	0.60
Main phobia											
IE	6.47	1.63	5.38	2.20	0.58	5.05	2.50	0.73	4.79	2.40	0.87
IE + IR	6.61	1.33	5.34	2.16	0.68	5.07	2.15	0.79	5.29	2.18	0.68
Anger control											
IE	.64	.16	.66	.17	0.12	.64	.16	0.00	.71	.14	0.46
IE + IR	.63	.16	.69	.19	0.35	.69	.19	0.36	.71	.15	0.52
Anger in											
IE	.45	.24	.42	.23	0.13	.41	.23	0.18	.41	.23	0.18
IE + IR	.56	.20	.48	.24	0.35	.51	.22	0.22	.49	.24	0.31
Anger out											
IE	.32	.19	.30	.20	0.12	.31	.20	0.06	.30	.20	0.11
IE + IR	.31	.14	.30	.15	0.06	.29	.14	0.12	.29	.16	0.11
SCL90 hostility											
IE	11.46	5.65	10.64	5.51	0.15	11.54	6.04	−0.01	10.28	5.38	0.21
IE + IR	12.82	5.89	11.07	5.52	0.31	11.29	5.56	0.26	10.61	5.05	0.40
Guilt											
IE	.54	.72	.64	.78	−0.12	.67	.81	−0.15	.69	.86	−0.17
IE + IR	1.32	.94	.82	.94	0.59	1.04	1.00	0.32	.93	1.02	0.44
Shame											
IE	.67	.98	.69	.92	−0.02	.74	.99	−0.07	.64	.93	0.03
IE + IR	1.00	.90	.82	.94	0.19	.89	.99	0.11	1.04	1.00	−0.04

Note: Cohen's *d* computed for the within condition change with respect to pretest, with the pooled pretest and assessment point SD's of both conditions. Positive *d*'s denote improvement, negative *d*'s worsening.

[a]Note that many patients received additional treatment between 1-month and 6-month follow-up. The 6-month follow-up data cannot be interpreted as condition effects and are presented only for descriptive purposes.

3.2.5.3. Anger control. A repeated measures ANOVA revealed a significant main effect of time, i.e. an increase in anger control, $F(1.71, 111.07) = 7.40$, $p = .002$, $\eta^2 = .102$; and a significant interaction between condition and time, with the IE + IR condition having the strongest increases in anger control, $F(1.71, 111.07) = 5.88$, $p = .006$, $\eta^2 = .083$. At posttest the condition by time interaction was significant, $F(1,65) = 6.68$, $p = .012$, $\eta^2 = .093$; as it was at 1-month follow-up, $F(1,65) = 7.86$, $p = .007$, $\eta^2 = .108$.

3.2.5.4. Anger in. The reduction in this anger factor tended to be larger in the IE + IR condition (Table 3). Robust ANCOVA indicated that at posttest there was a trend that IE + IR was superior to IE in reduction of Anger In scores, $p = .085$, equivalent $d = .42$. At 1-month follow-up, the condition effect failed to reach significance: $p = .54$, $d = .15$.

3.2.5.5. Anger out. Robust ANCOVA's yielded a non-significant condition effect for posttest, $p = .17$ ($d = .34$); but at 1-month follow-up the difference was significant, in favor of IE + IR, $p = .039$ ($d = .50$).

3.2.5.6. Hostility. Robust ANCOVA's indicated that the reduction in SCL-90 hostility scores didn't differ between conditions at posttest, $p = .47$, $d = .18$; but at first follow-up IE + IR was superior to IE, $p = .0175$, $d = .58$.

3.2.5.7. Guilt. A repeated measures ANOVA revealed no main effect of time, $F(1.42, 92.44) = 1.74$, $p = .19$, $\eta^2 = .026$; and a significant interaction between condition and time, $F(1.42, 92.44) = 4.13$, $p = .03$, $\eta^2 = .06$. The reduction in guilt ratings was significantly stronger in the IE + IR condition at posttest $F(1,65) = 5.96$, $p = .017$, $\eta^2 = .084$ (Table 3). At 1-month follow-up the difference remained in the same direction but had reduced to a trend, $F(1,65) = 2.83$, $p = .097$, $\eta^2 = .042$.

3.2.5.8. Shame. Robust ANCOVA's revealed that at none of the post-treatment assessments the change in shame was significantly different between conditions, $p = .31$, $d = .25$ (posttest); $p = .61$, $d = .12$ (first follow-up).

3.3. Therapists' preferences

After the trial we asked the therapists (the first author excluded) to fill in a short anonymous questionnaire about their experiences with and preferences for IE and IE + IR, and their reasons for that. Seven of the ten responded. None preferred IE, three indicated no preference, and four preferred IE + IR, $p = 0.059$, binomial test with $p0 = 1/3$. A permutation test, with H0 = equal preference, demonstrated that the mean observed preference rating of .57 on a scale from −1 to 1 (−1 = IE, 0 = no preference, 1 = IE + IR preference) had a significance level of $p = .052$. Thus, therapists tended to prefer IR + IE above IE alone. Four out of 7 therapists reported to experience less helplessness and felt it to be less emotionally distressing to witness the painful emotions patients often experience during treatment in the IE + IR than in the IE treatment. One therapist reported that she tended to dissociate less herself during emotionally distressing reports of traumatic events during IR. Their observation was that patients too learned they are now not as helpless anymore as they were during the traumatic event. The other three therapists did not express any preference for either treatment.

4. Discussion

In the present study three hypotheses were tested. First, we hypothesized that treatment is superior to WL in reducing overall PTSD severity. Results showed that treatment was indeed more effective in reducing PTSD-symptoms than a wait-list. The percentage of good end-state functioning in the intention-to-treat sample was 57% at posttest, and 49% at 1-month follow-up, and 52% at 6-months follow-up, which is comparable to Foa et al.'s (1999) finding of 52%, and higher than the average 43% for exposure treatments we derived from previous studies (see Appendix A). Second, we hypothesized that IE + IR was superior to IE in reducing PTSD symptomatology. This hypothesis was not confirmed by the results of the study. The addition of IR did not enhance the effectiveness of IE

treatment in this respect. But, there was a significant difference in dropout rates between the treatment conditions. The addition of IR to IE was associated with a significantly and considerably lower drop-out rate (51% vs. 25%), without making the treatments less effective in terms of PTSD symptom reduction. The third hypothesis, that IE + IR would be superior to IE in reducing a broader spectrum of PTSD-related variables such as anger, anger control, guilt, and shame was supported by the results. Completers and Intention-to-Treat analyses yielded generally the same differences between conditions: IE + IR was superior in both analyses with respect to anger control (posttest and follow-up), externalization of anger (at follow-up), hostility (at follow-up), and guilt (posttest and follow-up, with one of the four tests yielding a trend). Thus, despite the high drop-out rates from treatment and assessments, these results seem fairly robust. The results were less clear with respect to internalization of anger and shame, where completers and ITT analyses diverged.

By using the last-observation carried forward method to impute missing data in the intenten-to-treat analysis, we assumed in many cases no improvement at all. This is usually considered to be a conservative estimation of the true effect of treatment. Completers analyses on the other hand might overestimate the true effect of treatments because completing treatment is usually associated with a better response. The true effect of treatment will therefore probably lie somewhere between the results from the intention-to-treat analysis and the completers analysis. We therefore conclude that it is highly probable that the addition of IR to IE leads to better effects on anger control, externalization of anger, hostility and guilt; and perhaps on shame and on a quicker response on internalization of anger.

One potential adverse effect of IR, that is loss of anger control and an increase in aggressive behavior, was not observed, at least not on the basis of the self-reports on the anger control and externalization of anger scales. On the contrary, the addition of IR to IE led to a larger increase in anger control (thus less aggressive expressions), and less experienced anger. Apparently, the expression of anger in fantasy increased control over anger and reduced feelings of hostility and anger. Similarly, it might be argued that if there was a disinhibition of aggressive impulses, patients might then experience an increase in guilt and shame over these acting out behaviors. But on the contrary, addition of IR to IE had a better effect on these variables than when IE was applied alone.

After the trial we asked the therapists (the first author excluded) to fill in a short anonymous questionnaire about their preferences for IE and IE + IR. Therapists tended to prefer IE + IR, giving personal as well as therapeutic reasons. Given that IE + IR was at least as effective as IE alone, the preference of therapists and their report of experiencing less distress and helplessness is another reason for the application of IR in practice. Although the degree of secondary traumatization of IE therapists might have been overstated in the past (van Minnen & Keijsers, 2000), a treatment at least as effective as IE that promotes therapists' wellbeing might be preferable in clinical practice. An interesting issue is to what degree therapists' preferences influence the treatment effects. We were however unable to address this issue with the present data, as therapists responded anonymously.

The present findings seem to diverge from those of Grunert et al. (2007). In that study it was found that IR was extremely helpful for PTSD patients with an industrial accident trauma who did not profit from IE alone, suggesting that IR is superior to IE alone in reducing PTSD symptoms. We found equal effectiveness of IE and IE + IR on PTSD

symptoms. However, from our data it cannot be concluded whether or not IR would have been helpful for those patients who did not profit from IE alone, as we did not treat IE-failures with IR. Note that there are also several other differences between the studies, including different trauma types and different types of IR. Nevertheless, the finding that IR is in particular effective for non-fear emotions like anger, hostility and guilt, is very similar in the two studies. The usefulness of IR for non-fear emotions may be particularly important given the high frequency of non-fear emotions in PTSD samples. For example, in patients with PTSD in a public outpatients clinic, only 42% of reported emotions were of fear, helplessness and horror, with the remainder including anger and shame which do not form part of the diagnostic criteria for PTSD (Holmes et al., 2005).

Our sample consisted of participants with a variety of traumas. Given that the rationale of adding IR to IE was to better target emotions and cognitions related to helplessness, anger, shame and guilt, one might wonder whether IR is especially effective in survivors of assaults, and less in survivors of accidents. The sample size was too small to test this issue. Nevertheless, therapists reported no difficulties with applying IR in treatments with patients with non-assault traumas. The survivor of an industrial accident, for instance, expressed his anger towards his boss about the accident and the way in which he was treated afterwards. A survivor of a natural disaster (car drove against a tree suddenly falling on the road in the midst of a storm) expressed her feelings towards her partner deciding to drive in the storm, towards her daughter not wearing a safety belt, and towards the medical specialists who did not take her pain after the accident seriously enough. Another survivor of a car accident struggled with very angry feelings towards the driver behind him, who crashed against his car when he stopped for the traffic lights. Thus, although this issue needs an empirical test, the clinical impression is that IR can be applied to patients with non-assault traumas.

A weakness of the present study is the lack of a formal treatment integrity check. Independent raters did not formally assess treatment sessions. Therapists met once a week with each other and their supervisor (A.A.) to discuss their progress as well as problems and questions concerning the treatment protocols. Quality of treatment as well as sufficient difference between treatment conditions was thus monitored, but not formally checked. Nevertheless, the differences in specific effects of the two treatments indicate a substantial divergence between the two treatments.

Further limitations of the present study include the use of simple, non-validated assessments of trauma-related guilt and shame. Another limitation is that we did not use a structured interview to assess PTSD symptoms and diagnosis after treatment. We did not stratify allocation to condition on participants' characteristics like trauma type, gender, duration of PTSD, severity of PTSD and other relevant variables like guilt and anger dimensions. Although none of these variables differed significantly between conditions, slight differences might have influenced the results. In theory stratification might be a solution, but it is impossible to stratify on all possibly relevant variables. The problem then is to decide beforehand on what variable one should stratify. In absence of any strong empirical or theoretical argument (Van Minnen, Arntz, & Keijsers, 2002), we decided for an unstratified randomization. The study had a limited follow-up period. Although there was a 6-months follow-up, the results could not be used for statistical tests as patients received, if indicated, additional treatment. It remains therefore to be tested how IE + IR compares with IE in the long term. Lastly, it cannot be concluded from

the present study what the effects of IR alone might be, as IR was only studied as an addition to IE.

One of the strengths of the present study however is the large number of participants, as well as the fact that participants suffering from PTSD were recruited from the usual population of a clinical mental health center. Thus, participants were suffering from PTSD-symptoms due to a wide range of traumas. Whereas in many studies only male combat veterans or female rape victims participate, or only single trauma's are allowed, in the present study no restrictions were made to gender, severity of PTSD-symptoms, type of trauma, the age of onset nor to number of experienced traumata. Thus our study had good external validity. It is conceivable however that the lack of restrictions does partially account for the high percentage of dropouts (38% on average). But, although our dropout rates were higher than those found in a recent meta-analysis (28% for conditions involving prolonged exposure; Bradley et al., 2005), it can be argued that our findings are not exceptional. In the Appendix A we extended Bradley et al. (2005) meta-analysis by including studies published after their meta-analysis, and found evidence that the actual drop-out rate from exposure treatment is to be estimated by 36%. It is remarkable that our treatment drop-out percentage was comparable to the WL drop-out percentage (31%). Our WL drop-out was much higher than is usually the case in RCTs: a meta-analysis found an average drop-out from WL of 10% (Bradley et al., 2005). This suggests that we had a highly unstable group of patients, who had a high chance of changing their decision that they want treatment, independently from the treatment itself. The impressions of our clinicians are similar: they reported that many patients were from poor and unstable backgrounds, with highly ambivalent feelings about a treatment directed at trauma processing. Many of them sought relief of their emotional problems, but had to be convinced that a processing-focused treatment would help better than a treatment avoiding the painful aspects of their traumatic memories. By hindsight, it seems that many of these patients found it difficult to fully engage in treatment and stopped it prematurely. In any case, it is noteworthy that the majority of the patients that dropped out of treatment said that they found the treatment too aggravating (15 (38.5%) of the 39 IE patients; 5 (17.2%) of the 28 IE + IR patients, see Fig. 1).

The fact that our sample consisted of patients from regular health care, and was not especially recruited for participation in a treatment study, might also be an explanation why our effect sizes were smaller than is generally found with CBT and exposure treatment for PTSD (e.g. completers: about 1.3 for PTSD symptom self-report, Van Etten and Taylor, 1998; about 1.5 for PTSD interview and self-report combined, Bradley et al., 2005; see Appendix A for our estimates of effect sizes on PTSD symptom measures with exposure treatment: 1.0 for intention-to-treat, 1.5 for completers). Supporting this explanation is the finding that the change in PSS scores after wait was zero, which deviates from the average WL effect size of 0.35 (95% CI 0.19–0.51; Bradley et al., 2005), and from an effect size of .80 reported in a recent study by Foa et al. (2005). The deviating waiting-list figures indicate that our sample was different from most samples studied in RCT's so far. Another explanation is the high standard deviations, caused by extreme variations in symptom reports, already at baseline. Note that the PSS standard deviations at baseline were about twice as large as those reported by Foa et al. (1999, 2005), and others (Ehlers, Clark, Hackmann, McManus, & Fennell, 2005; Resick, Nishith, Weaver, Austin, & Feuer, 2002). Large baseline standard deviations usually imply large post-treatment standard deviations (as pre-test and post-test scores usually correlate). As the usual Cohen's d in

treatment outcome research is estimated by dividing the pre–post difference between the means by the pooled standard deviations of the two assessments, large pretest deviations imply small effect sizes (note that with a two-times smaller standard deviation, Cohen's *d* increases with a factor 2, implying that we would have found a *d* of 1.60 instead of .80 for PSS change after IE). Note that a similar reduction of effect size (and increase in drop-out rate) was found in Ehlers and Clarks Cognitive Therapy of PTSD, when it was applied in a non-university setting (Duffy, Gillespie, & Clark, 2007; Ehlers et al., 2005).

Still another reason might be that we investigated IE without the usual addition of *in vivo* exposure. There are indications that this is a powerful part of exposure treatment of PTSD (cf. Bryant et al., 2003). Nevertheless, the mean PSS score of about 18 post-treatment was highly comparable to the average of 17 calculated over studies in a recent meta-analysis (Bradley et al., 2005). Moreover, our proportions improved patients (completers post-treatment 62% and 63%) were also highly comparable to those found in a recent meta-analysis (68%), and higher than the estimate of 54% for completers we calculated after including recent studies to those analyzed by Bradley et al (2005) (see Appendix A). Thus, the effects found in the present study are probably underestimated by the effect sizes we reported, as they are heavily influenced by heterogeneity in symptom level reports.

Future studies should focus on the application of IR alone as treatment for PTSD, instead of as an adjunct to IE. When applied alone IR might be even more effective and better tolerable than when combined with lengthy IE. On the other hand, one could argue that the prolonged IE part is necessary to elicit the type of memories that have to be addressed, so that when applied alone, rescripting might not be as effective. It might also be important to compare this primarily experiential method to more purely cognitive methods, that do not involve such extended affect activation, like Beckian CT, Ehlers and Clark's CT (Ehlers et al., 2005—though note that in this protocol some IR is integrated), or meta-cognitive therapy (Wells & Sembi, 2004), or to a purely behavioral intervention as situational exposure *in vivo* (Basoglu, Salcioglu, & Livanou, 2007). There are obvious clinical reasons for such studies, but a comparison of IR with a method that does not focus at all at sensory aspects of the trauma memory may be informative for theoretical reasons also. For example, it has been argued that imagery has a more powerful impact on emotion than verbal processing of the same material—both in terms of generating negative affect (Holmes & Mathews, 2005), but also promoting positive emotion (Holmes, Mathews, Dalgleish, & Mackintosh, 2006). This provides a theoretical rationale for working at the level of imagery (rather than just verbal thought) in cognitive therapy, but remains to be tested for example in clinical samples with PTSD. It has often been argued that in PTSD traumatic memories are predominantly represented on a sensory level, with a lack of conceptual representation (Arntz, de Groot, & Kindt, 2005; Brewin & Holmes, 2003; Ehlers & Clark, 2000; Halligan, Clark, & Ehlers, 2002; Holmes, Brewin, & Hennessy, 2004; Holmes et al., 2005; Kindt, Buck, Arntz, & Soeter, 2007). IR seems to combine addressing trauma memories on an experiential (i.e., sensory) level, with transforming the representation to more conceptual levels (Kindt et al., 2007), addressing a wider range of cognitive and emotional aspects of the trauma than IE alone (Arntz & Weertman, 1999; Smucker & Niederee, 1995).

In conclusion, the present study demonstrated that both IE and IE + IR are effective in reducing PTSD symptoms. It is conceivable that the exposure element was of primary importance here. However, addition of IR techniques lead to significantly better effects on anger control, externalized anger, hostility, guilt and perhaps shame. Moreover, less

patients dropped out of the IE + IR treatment than of the IE treatment, indicating that rescripting made the treatment more tolerable. However, the alternative explanation that some therapists preferred rescripting which may have affected how well they provided IE, which in turn caused more people to drop out of that condition, cannot be excluded. Therapists tended to prefer the addition of IR. Future research might be directed at comparing IE with pure IR, comparing IR with non-experiential approaches, and developing treatment that is less aggravating for patients suffering from PTSD (and their therapists) and that keeps patients in treatment.

Appendix A

A.1. Drop-out rates, effect-sizes and improvement rates for PTSD treatments involving prolonged exposure estimated from RCTs

To compare our results with those of prolonged exposure reported by other studies, we analyzed drop-out rates, effect sizes for PTSD symptoms reduction, and improvement rates as derived from randomized clinical trials studied in Bradley et al.'s (2005) meta-analysis, and added the results from Foa's et al. (2005), Monson et al. (2006), and Schnurr et al.'s (2007) studies. We combined pure prolonged exposure treatments with those that had prolonged exposure as a substantial component (Bradley et al., 2005), as we detected no differences between the two types. In total data from 822 participants from 26 treatment conditions with prolonged exposure from 20 studies were involved.

A.2. Drop-out from exposure treatment for PTSD.

Twenty-six conditions involving exposure were analyzed. The average drop-out percentage was 22.5% (SD 11.4; median 25%; interquartile range 13–33%). Studies differed extremely in sample size, with the larger studies having higher drop-out rates, $r = .56$, $p = .003$ (sample size log-transformed to reduce skewness; Fig. 2). Year of publication also correlated with drop-out rate, with recent publications having a higher drop-out rate, Spearman's Rho = .56, $p = .003$, especially for pure exposure treatments (Fig. 3). To assess their relative contribution to drop-out, both rank of publication year and log-transformed sample size were entered as predictors in an ordinal regression (PLUM, SPSS), yielding a significant model, χ^2 (2) = 17.36, $p < .001$. Both publication year, Wald = 4.48, $p = .034$, and sample size, Wald = 6.88, $p = .009$, predicted higher drop-out rates. These findings suggest a bias towards too small drop-out estimates for exposure treatment from earlier studies and from studies with smaller sample sizes. Note that the larger and more recent studies often have higher internal and external validity (multi-center design, employing larger number of therapists, sampling participants from regular health care, more stringent control over patient recruitment and attrition, a better understanding of the importance of intention-to-treat analysis, etc.). Consequently, when weighted for sample size, drop-out % increased to 29.1%.

When only adequately powered trials were included ($N \geqslant 30$ per condition), only 4 trials remained with 6 conditions involving exposure treatment: Schnurr et al. (2003) having a 34% drop-out rate from $n = 118$; Resick et al. (2002) having 34% and 35% drop-out rates from $n = 41$ and $n = 41$; Foa et al. (2005) having drop-out rates of 34% and 41% from $n = 79$ and $n = 74$; and Schnurr et al. (2007), having a 38% drop-out rate from $n = 141$

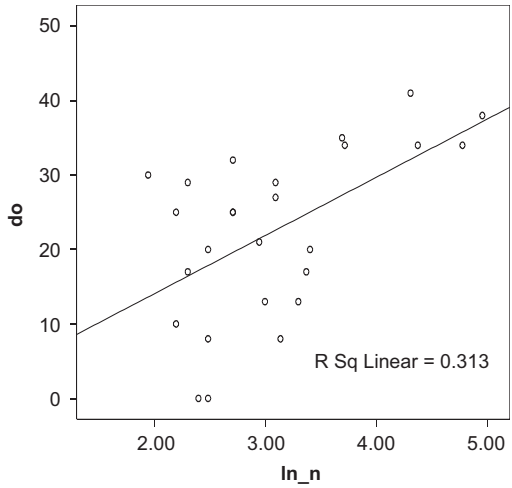

Fig. 2. Scatter graph with linear regression of drop-out rates as function of sample size from 26 conditions reported by 20 studies (log-transformed). Larger studies have higher drop-out rates.

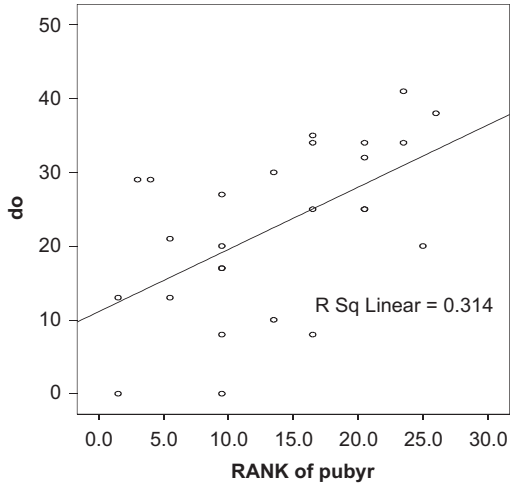

Fig. 3. Scatter graph with linear regression of drop-out rates as function of publication year (ranks) from 26 conditions reported by 20 studies (log-transformed). More recent studies have higher drop-out rates.

allocated to exposure. The average drop-out rate from these exposure conditions was 36% (*SD* 2.9). All these studies were published after 2000. Thus, it seems safe to conclude that 36% is a valid point estimate of the proportion of patients terminating treatments involving prolonged exposure prematurely.

A.3. Effect sizes for exposure treatment of PTSD

The effect sizes were taken from Bradley et al.'s (2005) meta-analysis (Table 2), with the effect size for pre–post change on the PTSD symptom score for the exposure condition of

the Schnurr et al. (2007) study added. The effect sizes ranged from .33 to 3.31, with a mean of 1.66 (*SD* .75) and a median of 1.57. Studies with the main developer of prolonged exposure treatment, Dr. Foa, as principal investigator tended to have larger effect sizes, mean 2.19 vs. 1.54, $t(24) = 1.81$, $p = .08$. Drop-out rate correlated with effect-size, $r = .45$, $p = .02$ (see Bradley et al., 2005, for similar observation). Studies with larger drop-out rates had larger completers effect-sizes, v.v. Excluding Foa's studies and controlling for drop-out rate, log-transformed sample size was strongly associated with smaller effect-size, partial $r = -.622$, $p = .003$. Thus, larger studies had smaller effect sizes for exposure treatments. Year of publication had no association with effect size.

To better adjust for the influence of drop-out on effect-size, we estimated (conservative) intention-to-treat effect sizes by assuming zero effect in drop-outs (for the added studies the reported ITT effect size was taken). The mean ES dropped to 1.23 (*SD* .47), median 1.22. The sample-size weighted mean was 1.07.

In sum, given the biases related to small-scale studies and the influence of drop-outs, a good estimate of the effect size for exposure treatment for PTSD seems to be approximately 1.5 for completers and 1.0 for intention-to-treat analyses.

A.4. Improvement rates

These were also derived from Bradley et al. (2005) with the new studies added (Foa et al., 2005, did not provide improvement rates). For exposure treatment, the average improvement rate across studies was 43% (*SD* 15, m.d. 41) for intention-to-treat analyses, and 54% (*SD* 15, m.d. 51) for completers. Correlations with publication year and sample size were virtually zero, also when both were forced into a regression analysis. Thus, these figures seem relatively unbiased with respect to sample size and publication year. In sum, for exposure treatment of PTSD the average (unbiased) improvement rates are 43% (ITT) and 54% (completers).

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