

Characteristics and Content of Intrusive Memories in PTSD and Their Changes With Treatment

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Although intrusive reexperiencing is a core symptom of posttraumatic stress disorder (PTSD), relatively little is known about its phenomenology. The present study assessed the characteristics and content of intrusive trauma memories in 22 patients with PTSD, and followed their changes in the course of cognitive behavioral treatment. Patients had a small number of different intrusive memories (1–4, $M = 2.2$) that occurred in an invariable, repetitive way. The intrusions were distressing and had a vivid perceptual content. They appeared to the patient to be happening in the “here and now.” With therapy, the frequency, vividness, distress, and newness of the intrusions faded gradually. There was no exacerbation with imaginal reliving. The content of intrusions was classified by raters to test A. Ehlers et al.’s (2002) hypothesis that intrusive memories are usually of warning stimuli that signalled the moments with the greatest emotional impact. The results were consistent with this hypothesis.

KEY WORDS: intrusive memories; warning signal; flashbacks; posttraumatic stress disorder; cognitive behavior therapy.

Intrusive reexperiencing is a core symptom of posttraumatic stress disorder (PTSD). Surprisingly, relatively little is known about its phenomenology (for reviews see De Silva & Marks, 1999; Falsetti, Monnier, Davis, & Resnick, 2002; Reynolds & Brewin, 1998, 1999). It has as yet not been systematically studied what aspects of the trauma memory are typically reexperienced, whether people reexperience different parts of the memory at different times, whether they reexperience the whole event, or just parts of it, and how these intrusive memories are experienced.

The 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, American Psychiatric

Association, 1994) highlighted that intrusive memories are recurrent, distressing, and involuntarily triggered. *DSM-IV* furthermore states that reexperiencing can take the form of “distressing recollections of the event, including images, thoughts or perceptions” (p. 428). The *DSM-IV* symptom definitions are based on expert consensus. Preliminary interview and questionnaire studies have only recently systematically asked people with PTSD to describe their intrusive memories, and have found that these mainly consisted of relatively brief sensory fragments of the traumatic experience (e.g., Ehlers et al., 2002). These could take the form of visual images, sounds, smells, tastes, or bodily sensations such as pain. It has been suggested, and supported by preliminary data, that visual intrusions are particularly common (Ehlers & Steil, 1995; Ehlers et al., 2002; Mellman & Davis, 1985). Interestingly, the participants in the above studies rarely described their intrusive (spontaneously triggered, unwanted) memories as thoughts. For example, Ehlers et al. (2002) found that 97% of childhood sexual abuse survivors

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described that their intrusive memories included visual sensations, but only 26% said that they included thoughts.

On the other hand, other findings suggest that intrusive thoughts are common in PTSD, and may even be more common than intrusive memories (e.g., Reynolds & Brewin, 1998, 1999). There appear to be different forms of intrusive trauma-related thoughts, many of which, in our view, do not appear to represent reexperiencing symptoms, as they do not consist of a recollection of the traumatic event itself. Examples for such nonmemory intrusive thoughts include evaluative thoughts about the trauma (Reynolds & Brewin, 1998, 1999), and rumination (e.g., "Why did it happen to me?" "How could the event have been prevented?" or dwelling on how one's life has been ruined by the trauma, e.g., Murray, Ehlers, & Mayou, 2002). Past research has not always separated intrusive memories from rumination and other intrusive thoughts that do not represent reexperiencing (e.g., Holman & Silver, 1998). Recent theoretical work, however, suggests that these different types of intrusions represent functionally distinct phenomena (DeSilva & Marks, 1999; Ehlers & Clark, 2000; Ehlers, Hackmann, & Michael, in press; Joseph, Williams, & Yule, 1997). The present paper follows this distinction, and concentrates on the characteristics of involuntarily triggered, unwanted trauma memories in PTSD.

DSM-IV (American Psychiatric Association, 1994) distinguishes between intrusive distressing recollections of the event and acting or feeling as if the traumatic event were recurring. In a dissociative flashback, the individual loses all awareness of present surroundings, and literally appears to relive the experience. The sensory impressions are reexperienced as if they were features of something happening right now, rather than being aspects of memories from the past. Despite the distinction made in *DSM-IV*, the lack of time perspective may also apply to other forms of reexperiencing in PTSD, in a less dramatic form, including intrusive images (criterion B1) or distress in response to reminders (criterion B4). Patients may not lose all awareness of present surroundings, but, as several authors have observed (Brewin, Dalgleish, & Joseph 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 1998), their intrusions are often accompanied by a sense of current threat and a sense of "nowness," i.e. the feeling that the sensations are experienced in the present rather than a memory from the past, and the emotions (including physical reactions and motor responses) accompanying them are the same as those experienced at the time ("original" emotions) Thus, a sense of "nowness" may not be restricted to flashback experiences, but may also apply to briefer intrusive memories that do not involve loss of awareness

of present surroundings. The vividness of the intrusive memories has also been highlighted (e.g., Brewin et al., 1996).

Like the qualities of intrusive memories, their content has rarely been investigated in a systematic way. In a recent study, Ehlers et al. (2002) observed that visual intrusive memories are particularly common across all types of trauma and pointed out that this is surprising, as one may have assumed that the most traumatic aspects of the event (and thus the most emotional) would be remembered best and would thus haunt the survivor in the form of reexperiencing. For example, one may have expected that a survivor of a stabbing would flash back to the moment when the knife entered the body and reexperience the pain and other physical sensations connected with this moment. Or one may have expected a rape survivor who was forced to perform oral sex on the perpetrator to reexperience the taste connected with this ordeal. However, interviews with trauma survivors showed that it is usually not the case (Ehlers et al., 2002). Instead, people seem to mainly reexperience visual or other sensory stimuli that they perceived shortly before such moments with the largest emotional impact (e.g., "Perpetrator standing at the window with the knife," "The perpetrator's eyes staring at me" in the above examples). Ehlers et al. (2002) argued that intrusive memories can be understood as stimuli that—through temporal association with the traumatic event—acquired the status of warning signals: stimuli, that if encountered again would indicate impending danger. This would explain why intrusive memories induce a sense of serious current threat, as Ehlers and Clark (2000) suggested.

Finally, little is known about how intrusive memories change with treatment. Whereas it is known that successful treatment of PTSD leads to substantial reductions in reexperiencing (e.g., van Etten & Taylor, 1998), the time course of these changes remains unclear. Intrusive memories may disappear abruptly, or may fade out gradually. If they fade rather than disappear the sense of reliving, vividness or distress provoked may fade in unison, or some aspects may disappear abruptly or at different rates.

The goal of the present interview study was to systematically investigate what aspects of their traumatic event people with PTSD reexperience, and what the qualities and content of these intrusive memories are. To test the warning signal hypothesis of intrusive memories, raters classified the content of intrusions systematically. Furthermore, the present paper explored the question of how intrusive memories change with treatment by tracking the frequency and qualities of patients' intrusive memories during cognitive behavioral treatment.

Method

Overview

Patients with PTSD were interviewed before starting a course of cognitive behavioral treatment. The semistructured interview assessed the frequency, vividness, associated distress, sense of “nowness,” and content of each of their intrusive memories. Patients completed rating scales each week during treatment for each intrusive memory, including any new intrusions that emerged.

Participants

Twenty-two patients (12 women, 10 men) with chronic posttraumatic stress disorder (duration 6 months or longer) who had been referred for cognitive behavioral treatment at an academic research unit participated in the study. Diagnoses were established with the Structured Clinical Interview for *DSM-IV* (First, Spitzer, Gibbon, & Williams, 1995). The patients' ages ranged from 20 to 64 ($M = 39.3$, $SD = 10.8$). They had experienced a wide range of different traumas (e.g., assault, $n = 5$, motor vehicle accidents, $n = 8$, other accidents $n = 3$, traumatic death/accident/suicide of relative $n = 4$, of other people $n = 2$). Their mean score on the Posttraumatic Diagnostic Scale (Foa, Cashman, Jaycox, & Perry, 1997) was 27.7 ($SD = 10.0$), indicating moderate to severe PTSD symptom severity. Their mean score on the Beck Depression Inventory was 22.1 ($SD = 12.2$), indicating moderate depression (Beck & Steer, 1992). Three patients suffered from concurrent major depressive episodes. Six patients were taking psychotropic medication (SSRIs $n = 5$, benzodiazepines $n = 1$), and had been on a stable dose for at least 2 months before treatment started; 5 patients were taking non-narcotic medication to control their pain, usually ibuprofen.

Intrusion Interview

All patients were interviewed individually before they started treatment, and after being diagnosed with the SCID. The intrusion interview consisted of a series of questions asked in a fixed order, and lasted approximately 30 min. The interviewer first asked “You have told us that memories of the (trauma) pop into your mind when you do not want them to. Could you tell me what these memories are like?” The content of the memories was noted. If patients reported more than one intrusive memory, the interviewer first asked them to choose and describe the major intrusive memory that was troubling them most. The interviewer then asked “Could you tell me a bit more about

how you experience this memory? What is it like?—and prompted “Is it more like a thought (please describe)? . . . like a feeling (please describe)? . . . or like a sensory experience?” If patients chose sensory experience, the sensory modalities were then explored. The frequency with which the intrusive memory had occurred in the previous week was noted, and patients rated its vividness, the distress associated with it, and the extent to which it seemed to be happening now instead of being something from the past on 0–100 scales (0 = *not at all*, and 100 = *very much*). Patients were asked about their awareness of anything that triggered the memory. They were asked what meaning the intrusion had for them, and to describe what happened before and after the moment represented in the intrusion.

Patients described their worst moment during the trauma to the interviewer, and were asked to classify whether the intrusion was about something that happened before, during or after the worst moment.

Patients were then interviewed in the same way for each other intrusive memory that had been coming to mind when they did not want it during the previous week.

Classification of the Content of the Intrusive Memories

Two raters independently classified the content of each memory using the following classification system that was based on the initial observations of Ehlers et al. (2002), and on further observations of the authors when treating PTSD patients.

1. Stimulus that was present shortly before the traumatic event began and signaled its onset (e.g., “Headlights coming towards me” before accident; “Perpetrator standing by my bed with a knife” before stabbing);
2. Stimulus that occurred in the course of the event, and signaled a moment when the meaning of the event became more traumatic (e.g., “Paramedics touching my shoulder”—which preceded them asking whether the patient was alright, a moment when the patient suddenly felt pain and realized she was injured; “Seeing curtains burning”—this made the patient realize that her living room was on fire, which led to the horrific thought that her daughter might be there and might be burning alive);
3. Moment before the trauma when everything still seemed OK (e.g., images of a pleasant day before accident happened);
4. Stimulus that represented a moment when the meaning of the event became better (e.g., seeing

- daughter alive after patient had assumed she was dead);
5. Moment when patient later wished he/she had done something differently (e.g., interaction with another person after the event—patient regretted later that she had not been friendlier at the time);
 6. Intrusion of elements from previous traumatic event when experiencing the present trauma (e.g., sound of previous accident in which mother was killed)
 7. Replay of a dissociative experience (e.g., seeing oneself from outside one's body).

Categories 1 and 2 both represent “warning signals”, and can be considered two examples of the same concept. They were distinguished for the purposes of the study as the onset of the trauma can be determined more unambiguously than later time points.

A minority of four intrusive memories (8%) were prolonged, i.e., contained a series of different sensory elements that occurred in succession (e.g., a stimulus signaling a moment when the meaning became more traumatic, and a memory from a previous traumatic event) and thus had to be classified in more than one category.

The classification originally contained a category for “worst moment of the trauma.” After reviewing the intrusions reported by the patients as representing the worst moment, they did not appear to differ in content from the other intrusions, and were thus also coded using the above categories. Results for intrusions from the worst moments of the trauma and other intrusions are reported separately.

The kappa for interrater reliability was .90. A consensus rating was agreed for the few cases of discrepancy between raters (all of these were between categories 1 and 2).

Intrusion Questionnaire

Before each treatment session, patients completed a short questionnaire about each of their intrusive memories that had been identified in the Intrusion Interview. The questionnaire asks patients to indicate how often the intrusive memory had occurred in the previous week, and to rate how distressing and vivid it had been, and the extent to which it seemed to be happening now instead of being something from the past, each on a scale from 0 (*not at all*) to 100 (*very much*). The retest-reliability of the questionnaire (1-week interval) in another sample of 44 PTSD patients (Speckens, Ehlers, Hackmann, & Clark, 2004) ranged between $r = .61$ and $r = .72$ for the four rating scales, respectively. The correlations between the corresponding scales on the Intrusions Interview and the questionnaire given in the first treatment session were:

frequency $r = .94$, distress $r = .74$, vividness $r = .70$,nowness $r = .84$, for the present study.

Patients were also asked whether any new intrusive memories had occurred in the previous week, and if so each new intrusion was rated in this and all subsequent treatment session. Effect sizes for changes in intrusion characteristics are based on Cohen's d statistic (Cohen, 1988), following the formula: $d = M_{\text{initial}} - M_{\text{post}} / SD_{\text{pooled}}$ with $SD_{\text{pooled}} = \sqrt{(SD_{\text{initial}}^2 + SD_{\text{post}}^2) / 2}$.

Cognitive Behavioral Treatment

After the Intrusion Interview, patients received a course of cognitive behavioral treatment (Cognitive Therapy for PTSD, see Ehlers & Clark, 2000 and Ehlers et al., 2003, in press, for a description of the treatment approach). The first treatment session involves discussion of the patient's symptoms and goals, a brief description of the traumatic event, assessment of factors maintaining the disorder and treatment rationale. In the following sessions, a combination of cognitive therapy techniques and imaginal reliving (Foa & Rothbaum, 1998) are used to elaborate the trauma memory. Cognitive therapy methods such as socratic questioning and behavioral experiments are used to change the problematic appraisals, including those of trauma sequelae (e.g., initial PTSD symptoms, responses of other people, or physical consequences of the trauma). Imaginal reliving and the writing of a narrative are used to reconstruct the traumatic event and to identify its worst moments (“hot spots”). For each of these moments, information that updates its meaning is identified and incorporated into the memory via verbal or imagery techniques. The updating information represents either information that became available to the patient at a later point in time during the trauma or its aftermath (e.g., the moment “I thought I'd lost my legs” is linked with the final outcome “I now know that I could actually move my toes and realized shortly afterwards that I was in one piece and would be able to walk”) or new conclusions that are the result of cognitive restructuring; (e.g., “I could have prevented the accident if I had done “ \times ” is replaced with “If I had done \times , I would have hit oncoming traffic and thus would have had an even worse accident”).

Imaginal reliving was usually conducted from the second treatment session onwards, but in a few cases started during the first or third session. For this minority of patients, data from the corresponding sessions were used for data analysis.

Patients received between 6 and 20 sessions of therapy ($M = 11.5$, $SD = 4.3$). The paper will focus on the first five sessions as these were available for all patients, and as the number of patients who still experienced

Table 1. Quality and Content of Intrusive Memories (Percent of Intrusions)

	Major intrusion (<i>n</i> = 22)	All intrusions (<i>n</i> = 47)
Sensory qualities		
Visual	86	79
Auditory	55	57
Taste/smell	23	15
Bodily sensations	68	66
Number of sensory qualities, <i>M</i> (<i>SD</i>)	2.3 (0.8)	2.2 (0.8)
Temporal relationship of intrusive memory to worst moment of trauma identified by patient		
Before	68	43
During	18	17
After	14	40
Content of intrusions that did not represent worst moment^a		
	<i>n</i> = 18	<i>n</i> = 39
Stimulus signalling trauma onset (1)	61	33
Stimulus signalling moment when meaning became more traumatic (2)	28	36
Prior moment when everything was OK (3)	11	8
Meaning changed for better (4)	0	8
Action regretted later (5)	6	13
Moments from another trauma (6)	6	8
Replay of dissociative experience (7)	6	3
Content of intrusions that represented the worst moment^a		
	<i>n</i> = 4	<i>n</i> = 8
Stimulus signalling trauma onset (1)	25	25
Stimulus signalling moment when meaning became more traumatic (2)	75	63
Element from another trauma (6)	25	13
Replay of a dissociative experience (7)	0	13

^aA minority of intrusive memories were prolonged and thus had to be classified in more than one category.

intrusions from session 6 onwards was too small (*n* = 9) for meaningful comparisons. The duration of each of the treatment sessions was 90 min.

Results

Intrusion Interview

Patients reported between 1 and 4 different intrusive memories (*M* = 2.2, *SD* = 1.0), and these comprised a total of 47 intrusive memories. Table 1 shows the results of the Intrusion Interview. With the exception of one intrusion that the patient described as a mixture of thoughts and feelings, all intrusions (*n* = 46, 98%) were described as a mainly sensory experience. The vast majority of intrusive memories included visual and/or bodily sensations. Auditory sensations were experienced during about half of the intrusions, and taste and smell sensations were least common.

Only 17% of the intrusive memories were about the worst moment of the trauma. Patients reported that their major intrusions were most commonly from before the worst moment of traumatic event. The major intrusions were significantly more likely to represent something that occurred before the worst moment than the worst moment itself, $\chi^2(1, N = 19) = 6.37, p < .05$, or than something that happened afterwards $\chi^2(1, N = 18) = 8.00, p < .01$.

Table 1 lists the content for those intrusive memories that did not represent the worst moment of the trauma (*n* = 18/22, 82% of the major intrusions, and *n* = 39/47, 83% of all intrusions). The raters classified the majority of patients' major intrusive memories as stimuli that preceded the onset of the trauma (category 1), followed by stimuli that signaled a moment when the meaning of the event became more traumatic (category 2).

When all intrusions were considered, the two most common types of intrusion were about a stimulus signaling a moment when the meaning of the event became more traumatic (category 2), and a stimulus signaling the onset of the trauma (category 1).

A minority of intrusions were of memories of moments when everything was still OK (category 3), before any intimations of the trauma. All three patients who had this type of intrusion reported that it occurred in conjunction with other intrusions of stimuli that immediately preceded the trauma (category 1). The small number (*n* = 4) of patients who had intrusive memories reflecting moments when things changed for the better (category 4) also had intrusive memories of contrasting moments when the meaning became more traumatic (category 2, *n* = 3) or of stimuli signaling the onset of the trauma (*n* = 1). For example, a patient who had an intrusive memory of looking down at her body after a road traffic accident and being relieved to see no signs of injury had another intrusive memory of a paramedic touching her shoulder, shortly

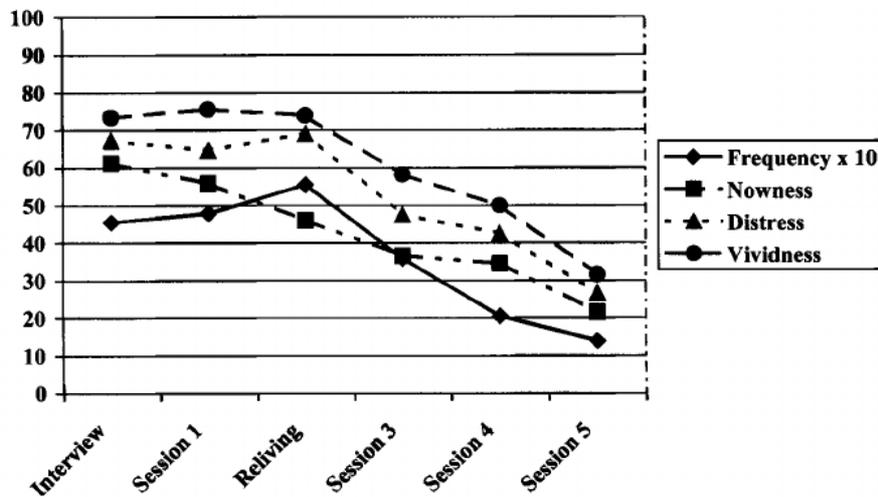


Fig. 1. Changes in the frequency and quality of the patients' major intrusive memory in the course of the initial sessions of Cognitive Behavior Therapy. Imaginal reliving of the traumatic event started in session 2. The different lines represent the frequency of the intrusive memory (multiplied by 10), the distress associated with it, its vividness, and the degree to which the intrusion appeared to happen in the present rather than in the past (nowness).

after which she experienced great pain and realized that she was badly hurt after all.

Interestingly, a small minority of intrusions contained elements of memories from previous traumas (category 6), which appeared linked in sensations and meaning. For example, one patient reported that the screaming he heard during his car crash triggered memories of the death of his mother. The corresponding intrusion contained both the screaming from the crash and an image of his dying mother.

A small proportion of the intrusions (6%, $n = 3/47$) contained elements that had not actually occurred during the event, but appeared to be an image of what could have happened. For example, a patient had an intrusion of a man landing on her bed. In the intrusion, she also heard the man laughing, although he had not laughed at the time.

When the content of the intrusions representing the worst moments was considered (Table 1), a similar pattern emerged. What was reexperienced was most commonly a stimulus that signaled the onset of the trauma or a moment when the meaning of the situation became more traumatic (categories 1 or 2). For example, a patient reexperienced a particular look on the face of his assailant. When he had seen this expression during the assault, he had realized that nobody was going to help him and thought he would never see his wife again. Another patient reexperienced the bump he had felt when driving his lorry. After he had felt the bump, he realized that a man he had seen shortly before had jumped in front of his lorry, and that he had killed him.

Patients noted a large number of situations that automatically evoked the intrusive memories. Different situational cues typically evoked different intrusive memories. For example, when trapped in heavy traffic a patient would hear the "explosion" that she heard at the time of the crash. On the other hand, being touched on the shoulder would evoke an intrusive memory of the paramedic touching her shoulder in the ambulance. For another patient, a letter on the hall table triggered the intrusive memory of his father's suicide note, whilst a reclining figure on the grass in a park would trigger an intrusive memory of his father's dead body stretched out in the garden after he had shot himself.

Intrusion Questionnaire

Figure 1 shows the changes in the intrusion characteristics over time for the major intrusive memory. Results are presented for the 19 patients with complete data. Results are plotted for the week preceding the Intrusion Interview, and the weeks preceding the first treatment session, the first reliving session, and the three subsequent sessions, respectively. The frequency of intrusions was multiplied by 10 so that it could be plotted on the same scale as the 0–100 rating scales for distress, vividness and nowness. The figure presents group means. Scores for individual patients also indicated gradual changes rather than abrupt discontinuation of the intrusive memories.

There was no change in the frequency of the major intrusive memories between the Intrusion Interview and the first reliving session, $t(18) = 1.41$, *ns*, $d = -0.19$. After the first reliving session, intrusion frequency decreased; reliving session versus session 3, $t(18) = 1.94$, $p < .07$, $d = 0.46$; versus session 4, $t(18) = 3.14$, $p < .01$, $d = 1.01$; versus session 5, $t(18) = 4.00$, $p < .01$, $d = 1.21$. The same pattern was found for the distress caused by the major intrusion: interview versus reliving session, $t(17) < 1$, $d = -0.07$; reliving session versus session 3, $t(17) = 4.39$, $p < .001$, $d = 0.67$; versus session 4, $t(17) = 4.67$, $p < .001$, $d = 0.87$; versus session 5, $t(17) = 5.68$, $p < .001$, $d = 1.37$. The ratings for vividness also showed the same pattern of results; interview versus reliving session, $t(18) < 1$, $d = -0.02$; reliving session versus session 3, $t(18) = 2.46$, $p < .05$, $d = 0.49$; versus session 4, $t(18) = 4.69$, $p < .001$, $d = 0.87$; versus session 5, $t(18) = 6.42$, $p < .001$, $d = 1.49$.

Nowness ratings of how much the major intrusive memories appeared to happen in the "here and now" already declined between the Intrusion Interview and the first reliving session, $t(18) = 2.43$, $p < .05$, $d = 0.48$. After reliving, they showed further decreases by session 5, $t(18) = 3.55$, $p < .01$, $d = 0.83$. There was a trend for the degree of reduction in nowness between the first reliving session and sessions 4 and 5 to be smaller than both the reduction in distress and the reduction in vividness; distress ratings reliving session versus session 4, $t(17) = 2.05$, $p < .06$; versus session 5 $t(17) = 1.93$, $p = .07$; vividness ratings reliving session versus session 4, $t(18) = 1.89$, $p < .08$, versus session 5, $t(18) = 1.88$, $p < .08$. The differences were significant when the average ratings for all intrusions reported by a patient were considered.

Only three patients noted any fresh intrusions in the course of treatment, and each of these lasted only for a few days before disappearing again. For example, a patient whose father had shot himself started having some intrusive memories of his father's shattered head after looking at photos of the father in therapy. He had avoided looking at photos since his father's suicide, and had not been able to remember what the father's head had looked like when he found the body.

Discussion

What Is Reexperienced?

The present paper investigated what aspects of traumatic events are reexperienced and whether people with PTSD reexperience different parts of the event at different times. A notable finding was that patients reported a

small number of involuntary intrusive memories of their traumatic event that occurred in a very repetitive way.

The repetitive nature of intrusive memories is a remarkable aspect of their phenomenology that may give important clues about their etiology and treatment. Ehlers and Clark (2000) observed that trauma survivors with PTSD reexperience their original emotions and sensory impressions even if they later (i.e., at another time during the event or afterwards) acquired new information that contradicted the original impression or if they know that these impressions did not turn out to be true. A striking example of the lack of updating of the intrusive memories in the present sample was the lady who had frequent intrusions of seeing the curtains burning which had led her to believe at the time that her daughter was burning alive. At other moments during the day, she had intrusions of seeing the dead body of her daughter in the mortuary that did not show any signs of burns (the daughter had been in a different room and had been overcome by fumes). Before treatment, the patient had never connected these two parts of the memory for the trauma, and the intrusions had persisted unchanged. Other patients had contrasting intrusions of moments when the meaning of the event became better and moments when the meaning became more traumatic; and these contrasting moments appeared to be relatively unconnected in memory. It thus appears that the repetitive nature of intrusive memories may be an indication of the failure to connect these moments with new information that is important for their meaning.

Although patients experienced the same intrusive memories over and over again, this did not always mean that these memories were an exact trace of what had happened, as a few of them included elements from previous traumas or images representing things that may have happened.

Qualities of Intrusive Memories

How are the repetitive intrusive memories experienced? In line with previous observations, the involuntary intrusive memories described by the present sample were relatively short sensory "snapshots" of the traumatic event (Ehlers & Steil, 1995; Mellman & Davis, 1985; Van der Kolk & Fisler, 1995). The intrusions had high perceptual content, and most patients experienced them in more than one modality. Visual intrusions were most prominent, in line with Ehlers and Steil (1995) and Ehlers et al. (2002), closely followed by bodily sensations. Bodily sensations included both manifestations of autonomic arousal and other proprioceptive material, which more clearly was part of the memory. For example, many patients experienced pain or feeling physically trapped whilst having an

intrusive memory. Auditory sensations were moderately common, and smells and tastes were least common.

Before treatment, intrusive memories were usually experienced with a strong sense that this was something that was happening now, rather than something from the past. This is in line with suggestions (Brewin et al., 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 1998) that a sense of "nowness" appears to be a general characteristic of intrusive trauma memories, including those that would meet the B1-criterion of *DSM-IV* (American Psychiatric Association, 1994), and does not appear to be restricted to flashbacks. The repetitive nature of the intrusions and the lack of integration of new information that updates the original impressions about what was going to happen are consistent with this subjective sense of "nowness." These characteristics would explain the strong emotional reaction to intrusive memories in PTSD, and the "sense of serious current threat" produced by the intrusions (Ehlers & Clark, 2000). Consistent with the present data, Michael, Ehlers, Halligan, and Clark (2004) found that the lack of time perspective of intrusive memories and the lack of context (operationalized by the degree to which they were experienced as isolated and disconnected from what happened before and afterwards) predicted the chronicity of PTSD symptoms in a prospective longitudinal study of assault survivors.

Test of Warning Signal Hypothesis

The content of the intrusive memories was systematically classified. On the basis of research showing that central elements of highly emotional experiences are remembered best (Christianson, 1992), one may have expected that the central, most traumatic, aspects of the event would be reexperienced. However, only a minority of 17% was about what the patient identified as the worst moment of the event. Instead, most intrusive memories represented stimuli that during the course of events predicted the onset of the trauma, or signaled the onset of moments when the meaning became more traumatic. This is consistent with Ehlers et al.'s (2002) interpretation that intrusive memories of trauma may be understood as reexperiencing stimuli that indicated impending danger at the time of the event, and have thus become warning signals indicating future threat to the individual. Intrusive memories would thus have functional significance in that they may help prepare a traumatized person for rapid action to avoid future danger if similar stimuli are encountered in the future.

The warning signal hypothesis can most clearly be evaluated for those stimuli that preceded the onset of the

trauma (category 1) as the time course of events can be unambiguously established (e.g., "Headlights coming towards me" predicting a head-on car crash). In line with the hypothesis, half of the patients' major intrusions were stimuli that preceded the traumatic event. Should stimuli that signaled a moment when the meaning of the event became more traumatic also be understood as warning signals? As these stimuli occurred during the course of the traumatic event, it is more difficult to establish temporal relationships unambiguously. However, the interviews indicated that these intrusions, even if they reflected the worst moments of the trauma, appeared to comprise reexperiencing of sensory stimuli that signaled the onset of a moment when the meaning became more traumatic, rather than a stimulus that occurred later on during that moment. For example, the patient who reexperienced the touch on the shoulder subsequently noticed her pain and realized that she was severely injured, consistent with a warning signal interpretation. However, further systematic evaluations of this type of intrusion are necessary. For example, it would be desirable to independently assess all the moments when the meaning of the event changed, and relate these to the intrusive memories reported by the patient.

Ehlers et al.'s (2002) observed that triggers of intrusive memories often appear to be stimuli that bear physical resemblance to stimuli that immediately preceded the "warning signal" that is later reexperienced, or to the "warning signal" itself (see also Charney, Deutch, Krystal, Southwick, & Davis, 1993; Foa et al., 1989; Foa & Rothbaum, 1998; Keane, Zimmerling, & Caddell, 1985; Kilpatrick & Veronen, 1983). The present study did not contain a direct test of this hypothesis, although the triggers reported by patients appeared to be associated with the content of the respective intrusions, in that patients described different matching triggers for different intrusive memories.

Changes With Treatment

We tracked the characteristics of intrusive memories during cognitive behavioral therapy, and found that ratings of frequency, distress, and vividness declined gradually. Thus, intrusions appeared to gradually fade away rather than cease abruptly. This applied to individual patients as well as to the group mean. Within this there were variations, as events such as anniversaries of the trauma could trigger more intrusions for some sessions. Within individuals different intrusive memories sometimes disappeared at different times, depending on the focus of the treatment. Patients sometimes reported that some of the sensory qualities of the intrusions were lost before the intrusion disappeared completely. For example, a patient

who had intrusions of strong blue and yellow colors together with the sound of screeching metal, reported that the colors faded first.

Talking about intrusions in the Intrusions Interview alone did not bring about a change the frequency and vividness of the intrusions and distress associated with them. One might have expected that imaginal reliving in session 2 would lead to a transient increase in intrusions, but this was not the case. The finding is in line with recent data published by Foa, Zoellner, Feeney, Hembree, and Alvarez-Conrad (2002) showing that imaginal exposure rarely leads to symptom exacerbation.

Interestingly, the extent to which the memories appeared to happen in the "here and now" followed a somewhat different pattern of change. Talking about the intrusions in the Intrusion Interview led to decreases in "nowness," possibly because talking about the experience in a new context may have provided a sense of perspective, and helped install the idea that this was something that happened in a different time and place. Further sessions that included imaginal reliving, cognitive interventions, and the incorporation of updating information into the memory led to further decreases in "nowness" by session 5, but the decrease appeared to be somewhat slower than for distress and vividness. The latter result should be interpreted with caution, as it was only significant when the average ratings for all intrusions reported by a patient were analyzed, rather than the ratings for the major intrusion. It is conceivable that the trend for a slower decrease in nowness observed in this study was related to the instruction to do the imaginal reliving of the traumatic event in present tense.

Intrusive Trauma Memories Versus Intrusive Thoughts About the Trauma

It was the goal of the present study to describe the characteristics of unwanted intrusive trauma memories in PTSD. We therefore did not assess any intrusions that were not memories of the trauma itself such as rumination or intrusive evaluative thoughts about the trauma that do not involve reexperiencing. This has to be taken into account when interpreting the results. As Reynolds and Brewin (1998, 1999) have shown, such intrusive thoughts about the trauma may actually be more common than intrusive memories of the trauma. A systematic comparison of the characteristics of these different types of intrusions in PTSD would be interesting. As their distinction has only recently been proposed in the literature (De Silva & Marks, 1999; Ehlers & Clark, 2000; Ehlers et al., 2002; Joseph et al., 1996), comparisons are as yet lacking.

Limitations

The present study had several limitations. A relatively small sample of patients was interviewed so that it remains to be tested whether the results will replicate to other samples. It also remains unclear whether the categories of intrusions experienced by patients in this sample will be sufficient to classify the full range of involuntary trauma memories. The traumatic events in the present sample were of relatively short duration, and it is possible that people who experienced more prolonged or repeated traumatic events have additional or different types of intrusive memories, for example, intrusions that combine elements or moments from a range of different traumas. In this context, it is of interest to note that some patients in the present sample reported that their intrusions contained elements from both the present trauma and a previous trauma. Furthermore, it would be desirable in future studies to systematically assess all the moments when the meaning of the event became more traumatic, and determine whether they are meaningfully linked to the patient's intrusive memories. Similarly, the present study did not assess the relative duration of the events during the trauma, and it would be desirable to test whether the proportion with which different aspects of the trauma occur as intrusive memories is not just a function of their duration. Finally, it would be desirable in future studies to distinguish between bodily sensations that represent reexperiencing of sensations from the trauma, and those that represent a stress response to having a distressing memory.

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