Imagery rescripting of traumatic memories for panic disorder: an exploratory study

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Abstract. Imagery rescripting (ImRs) is a psychological intervention designed to change the meaning of images and associated memories and reduce emotional distress. Recent studies have shown that ImRs can be successfully applied to many psychological problems and disorders; however, little has been reported on the application of ImRs for panic disorder (PD). Consequently, we explored the therapeutic effects of ImRs on patients with PD. Fifteen patients with PD received 16 individual cognitive behavioural therapy (CBT) sessions weekly, including one ImRs session. Early traumatic memories associated with recurrent images in panic situations were identified and rescripted to alleviate maladaptive encapsulated beliefs. ImRs ratings (vividness and distress of the images and memories and conviction degree of encapsulated beliefs) were measured prior to and after ImRs. Self-negative contents not directly related to symptoms of panic attack were observed as common themes in the worst meaning of the image, the memory, and in the encapsulated belief. Whilst five (33%) patients had anticipatory anxiety, 10 (67%) patients had other self-negative beliefs. ImRs significantly reduced distress from images, memories and encapsulated beliefs; however, it did not change the vividness of images and memories. There was no significant correlation between the reduction in PD severity over the CBT program and the change in each ImRs rating. The results of this study are promising for certain aspects of panic disorder. However, further research is needed to overcome the limitations of this study.

Key words: panic disorder, cognitive behavioural therapy, traumatic stress, memory, belief

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Introduction

Interest in and applications of imagery rescripting (ImRs) are rapidly increasing (Arntz, 2012; Hagennars and Holmes, 2012). ImRs is a set of therapeutic techniques addressing specific memories of earlier experiences associated with present problems (Arntz, 2012). In an ImRs procedure, aversive autobiographical memories are rendered less unpleasant or emotional (Slofstra *et al.*, 2016). ImRs describes a set of therapeutic techniques aimed at changing these negative meanings (Stopa, 2011). According to a historical review on ImRs by Edwards (2007), in the late 1980s and early 1990s, therapists such as Jeff Young (schema-focused therapy) and Mary-Ann Layden (personality disorder treatment) started to fully explain the application of imagery-based techniques in the framework of cognitive therapy (Young and Lindemann, 1992; Layden *et al.*, 1993). Smucker developed an imagery-focused treatment for adult survivors of childhood sexual abuse, designed to alleviate post-traumatic stress disorder (PTSD) symptomatology and alter abuse-related beliefs and schemas (Smucker *et al.*, 1995).

Arntz and Weertman (1999) expanded ImRs to include patients with personality disorders and attempted to address individual problems rooted elsewhere than childhood sexual abuse. Since then, the application of ImRs to many psychiatric disorders has been studied and practised: social anxiety disorder (SAD) (Wild *et al.*, 2007, 2008; Wild and Clark, 2011; Nilsson *et al.*, 2012; Lee and Kwon, 2013; Frets *et al.*, 2014; Reimer and Moscovitch, 2015; Norton and Abbott, 2016), PTSD (Arntz *et al.*, 2007; Long and Quevillon, 2009; Hackmann, 2011; Afkham and Toghchi, 2012; Arntz *et al.*, 2013; Hoffart *et al.*, 2013; Prasko *et al.*, 2015; Raabe *et al.*, 2015), depression (Patel *et al.*, 2007; Wheatley *et al.*, 2007; Brewin *et al.*, 2009; Moritz *et al.*, 2014), bulimia nervosa (Ohanian, 2001), ophidiophobia (snake phobia) (Hunt and Fenton, 2007), cancer patients with psychological distress and maladaptive adjustment derived from intrusive memories (Whitaker *et al.*, 2010), trauma-related nightmares (Long *et al.* 2011a,b), pain sufferers (Philips and Samson, 2012), psychosis patients with auditory hallucinations (Ison *et al.*, 2014), bowel/bladder control anxiety (Pajak and Kamboj, 2014), obsessive compulsive disorder (OCD) (Veale *et al.*, 2015), and body dysmorphic disorder (Ritter and Stangier, 2016; Willson *et al.*, 2016). However, our review of the literature failed to find any study on the application of ImRs to panic disorder (PD).

PD is an anxiety disorder characterized by recurring, unexpected panic attacks. A panic attack is an abrupt surge of intense fear or intense discomfort that reaches a peak within minutes, and during which time at least four of 13 panic symptoms occur. In the general population, the 12-month prevalence estimate for PD across the USA and several European countries is about 2–3% in adults and adolescents (American Psychiatric Association, 2013). As with many anxiety and depressive disorders, PD is often co-morbid with other psychological disorders and is associated with functional disability (e.g. social and occupational impairment; Kessler *et al.*, 2006). Although selective serotonin re-uptake inhibitors remain a first-line pharmacotherapy of PD (Batelaan *et al.*, 2011), cognitive behavioural therapy (CBT) has been shown to be more effective than pharmacotherapy. Clark *et al.* (1994) compared cognitive therapy, applied relaxation, imipramine (mean 233 mg/day), or a 3-month wait followed by allocation to treatment. During treatment, patients had up to 12 sessions in the first 3 months. Imipramine was gradually withdrawn after 6 months. Comparisons between treatments showed that at 3 months, cognitive therapy was superior to both applied relaxation and imipramine on most measures. Between 6 and 15 months, several imipramine patients relapsed. At 15 months, cognitive therapy was again superior to

both applied relaxation and imipramine. Furthermore, Roshanaei-Moghaddam *et al.* (2011) conducted a meta-analysis comparing CBT and pharmacotherapy, with or without placebo, in adults with major depressive or anxiety disorders. The primary effect size was calculated from disorder-specific outcome measures as the difference between CBT and pharmacotherapy outcomes (i.e. positive effect size favours CBT; negative effect size favours pharmacotherapy). The authors found that effects for PD significantly favoured CBT over medications (.50, 95% CI: 0.02, 0.98).

CBT for PD has been developed based on Clark's (1986) cognition model of panic attacks. Clark's approach is based on the idea that panic attacks are frequently the result of misinterpreting normal bodily sensations as a sign of an impending physical or mental catastrophe (such as a heart attack or going mad) (Clark *et al.*, 1997). This misinterpretation generates a feedback effect where anxiety, physical symptoms and negative thoughts reinforce each other.

Salkovskis *et al.* (1999) later added the hypothesis that safety-seeking behaviours play an important role in maintaining anxiety, because they prevent patients from benefiting from a disconfirmatory experience. Therefore, many versions of CBT for PD that are currently being performed seek to identify and change mistaken beliefs about physical symptoms and their consequences. Furthermore, it is an integral part of CBT for PD to conceptualize avoidance behaviours, a maintenance factor for PD, and to confront feared stimuli and situations (American Psychiatric Association, 2009).

Intrusive images and traumatic memories of patients with PD have not yet been fully studied. Day *et al.* (2004) explored recurrent images in patients with agoraphobia and found that all participants with agoraphobia (but no control participants) reported experiencing distressing, recurrent imagery in agoraphobic situations. The imagery was reported as being associated with unpleasant memories of events. Wenzel *et al.* (2006) developed the Panic Beliefs Inventory (PBI) to assess the dysfunctional attitudes and beliefs that panic patients have about specific symptoms and panic in general. An exploratory factor analysis on a large sample of panic patients revealed that the instrument was divided into four factors – Anticipatory Anxiety, Physical Catastrophes, Emotional Catastrophes, and Self-Deprecation – that were later translated into four scales that could be summed to obtain a total score, reflecting the higher order construct of maladaptive panic beliefs. Wenzel and Cochran (2006) examined the retrieval of autobiographical memories prompted by automatic thoughts representative of maladaptive schema content specific to PD, SAD and non-anxious participants. Panic participants retrieved memories cued with panic disorder-related automatic thoughts more quickly than SAD and non-anxious participants, indicating that panic participants were characterized by general threat-relevant autobiographical memory biases. Considering these studies, PD patients may be significantly influenced by limited information from past traumatic events when processing current panic situations. Thus, in the same way that ImRs has been shown to be effective in SAD (Wild *et al.*, 2007, 2008; Wild and Clark, 2011), rescripting traumatic memory in images may result in improvement in PD patients.

There is an option to apply a PTSD protocol as per Ehlers and Clark (2000) to panic patients. Just like traumatic experiences, panic attacks are perceived as sudden, overwhelming and subjectively life-threatening events. In addition, in PD with agoraphobia, patients typically respond to a panic attack with intense fear and helplessness. This means that some of the memory characteristics in PTSD trauma memory should also characterize memory of

severe panic attacks in PD of agoraphobia patients (Hagenaars *et al.*, 2009). The reason for choosing ImRs instead of a PTSD protocol in this study was that PD trauma memories had less re-experiencing elements than PTSD trauma memories (Hagenaars *et al.*, 2009). Thus, the traumatic memory of patients with PD is not as fragmented as that of patients with PTSD, and therefore does not require much elaboration. The purpose of this study was to add ImRs to conventional CBT for PD patients and to explore its effectiveness.

Method

Study design

Our study was conducted in a single-arm, uncontrolled trial of individual CBT for PD in a Japanese clinical setting (Seki *et al.*, 2016), registered in the National UMIN Clinical Trials Registry (ID: UMIN000022693).

Participants

Fifteen patients were enrolled through clinical referrals from specialist clinics and from the community via web-based advertisements, as described in Seki *et al.* (2016). We predicted a need for 15 participants, assuming that eight therapists were responsible for an average of 2.5 participants who were enrolled during the registration period (April 2014 to July 2016), and three-quarters of participants would withdraw; however, in this study, we excluded three patients, as they had not received an ImRs session, or there was a lack of available data concerning ImRs for these patients. Apart from that, we added three new patients via the same route within the study period. Ultimately, 15 patients were enrolled. Written, informed consent was obtained from all patients.

We used the following inclusion criteria: primary diagnosis of PD according to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) criteria, aged between 18 and 65 years with at least moderately severe PD [a Panic Disorder Severity Scale (PDSS) score $\geq$ 8; Houck *et al.*, 2002]. Co-morbid diagnoses were permitted if they were clearly secondary (i.e. the PD symptoms were both the most severe and the most impairing).

Exclusion criteria were as follows: psychosis, pervasive developmental disorders/mental retardation, a current high risk of suicide, substance abuse or dependence in the past 12 months, or anti-social personality disorder. All patients were evaluated by a psychiatrist using the Mini-International Neuropsychiatric Interview (Sheehan *et al.*, 1998; Otsubo *et al.*, 2005). Therapists and chart review confirmed treatment history. Participants' characteristics are shown in Table 1.

Treatment

Individual CBT was conducted in 16, 50-minute, weekly sessions. We developed our CBT program for PD to focus on changing catastrophic misinterpretations of bodily sensations, as per the Clark *et al.* model (1997). We also applied several concepts from the Clark and Wells model for SAD (1995). We added the concept of the detrimental effects of safety behaviours, attentional bias modification (attentional shift training), behavioural experiments including interoceptive exposure (systematic exposure to body sensations), ImRs, and reconsideration of worry/rumination to strengthen anticipatory anxiety.

Table 1. *Participants' baseline demographic and clinical characteristics (N = 15)*

Age (years, mean (*SD*))	37.9 (8.6)
Sex (female, *n* (%))	13 (87)
Marital status (married, *n* (%))	6 (40)
Educational level (< 3 years of college/university, *n* (%))	7 (47)
Working status (full-time employed, *n* (%))	5 (33)
Co-morbid agoraphobia (*n* (%))	14 (93)
Co-morbid axis I diagnosis (no co-morbid condition, *n* (%))	12 (80)
Current anti-depressant medication (*n* (%))	8 (53)
Age of onset of PD (years, mean (*SD*))	28.5 (10.0)
Duration of PD (years, median (IQR))	5.0 (2.0–18.0)
Age at traumatic memory (years, mean (*SD*))	23.8 (11.3)
Pre-PDSS score (mean (*SD*))	13.1 (4.8)

SD, standard deviation; PD, panic disorder; IQR, interquartile range; PDSS, Panic Disorder Severity Scale.

The main treatment steps were as follows:

(a) Assessment
(b) Psychoeducation
(c) Case conceptualization
(d) Role play experiment with or without safety behaviour
(e) Cognitive reconstruction of catastrophic body sensation image
(f) Attention shift training
(g) Behavioural experiment
(h) ImRs of traumatic memories
(i) Modifying problematic pre- and post-event processing
(j) Comparison of belief in oneself and others for the worst situation (surveys of other people's observations)
(k) Schema work
(l) Relapse prevention
(m) Termination

The rationales for the application of some concepts from the SAD model to PD treatment are shown below:

Attention shift training

Attention shift training in this study was intended to direct participants' attention away from internal sensations. The effectiveness of attention training on patients with PD has been suggested by Wells (1990) and Wells *et al.* (1997). Wells (1990) reported a case of relaxation-induced anxiety in a patient with PD. He reported the use of an attention training procedure, which was effective in eliminating panic and facilitated tension reduction without producing anxiety. Wells *et al.* (1997) investigated the effects of attention training on panic frequency, general anxiety, and beliefs across two PD cases and one SAD case, and the results were consistent with those of a previous study (Wells, 1990) and provided preliminary evidence that

panic attacks, anxiety and negative beliefs can be effectively and lastingly reduced through cognitive techniques that do not directly target the content of negative appraisal.

Reconsideration of worry/rumination

Reconsideration of worry/rumination in this study was intended to examine the advantages and disadvantages of post-event processing (PEP). Research on PEP, where individuals conduct a post-mortem evaluation of a social situation, has focused primarily on its relationship with SAD. Laposa *et al.* (2014) examined the relationship between PEP and disorder-specific symptom severity for SAD, OCD, PD and generalized anxiety disorder (GAD). PEP ratings were found to be associated with disorder-specific symptom severity in SAD, GAD and PD, but not in OCD. The results showed that PEP might be a transdiagnostic process with relevance to a broad range of anxiety disorders, not just SAD.

The ImRs procedure in this study was based on the application of ImRs to SAD by Clark and colleagues (Wild *et al.*, 2008; Wild and Clark, 2011). Based on three randomized controlled trials confirming the effectiveness of a cognitive therapy (CT) program and suggesting that a group format may not be advantageous (Clark *et al,.* 2003; Stangier *et al*., 2003; Mortberg *et al*., 2007), Clark *et al.* (2006) compared CT with exposure plus applied relaxation (EXP+AR), or wait-list (WAIT). CT and EXP+AR were superior to WAIT on all measures and CT led to greater improvement than EXP+AR. Percentages of patients who no longer met diagnostic criteria for social phobia at post-treatment–wait were as follows: 84% in CT, 42% in EXP+AR and 0% in WAIT. At the 1-year follow-up, differences in outcomes persisted. Wild *et al*. (2007, 2008) conducted two studies to assess the effects of ImRs alone in unselected populations of patients with SAD. The authors' ImRs protocol was broadly based on Arntz and Weertman's adaptation of the Smucker protocol (Arntz and Weertman, 1999; Smucker *et al.*, 1995). Wild *et al*. (2007) reported pre- and post-rescripting results in 14 patients with SAD. The results showed that ImRs alone was associated with significant improvements in patients' negative social beliefs, the vividness and distress of their image and early memory, and in self-reported measures of social anxiety. Wild *et al*. (2008) then compared a session of ImRs with a control session in which images and memories were explored without being updated. The result showed that the ImRs session was associated with significantly greater improvement in negative beliefs; image, memory distress, and vividness; fear of negative evaluation; and anxiety in feared social situations. Subsequently, Wild and Clark (2011) described the importance of updating negative imagery in SAD, which is the theoretical basis for SAD.

As already mentioned, our ImRs protocol was based on Wild *et al.* (2008) and Wild and Clark (2011). The procedure by Wild *et al.* was broadly based on Arntz and Weertman's adaptation of the Smucker protocol (Arntz and Weertman, 1999; Smucker *et al*., 1995). The ImRs procedure in this study was as follows:

Identifying the recurrent image, the linked memory and the encapsulated belief

A semi-structured interview, based on Hackmann *et al*. (2000), was conducted for patients to identify recurrent images in panic situations, along with an early traumatic memory linked to the image. First, the patients were asked to recall and describe an image that appeared repeatedly in panic situations. Then, they were asked to rate the vividness and distress of the

image. Following this, patients were asked what the image meant to them, answering these questions: 'What is the worst thing about the image?' and 'What does it mean about you as a person?'. Patients were then asked when they first remembered feeling the way they did in their image and to describe the events associated with that feeling. The patients were also asked what the early traumatic memory meant to them, answering similar questions. The patients were asked to rate the vividness and distress of the memory. Subsequently, the patients were asked to summarize the meaning of the image and the memory in one or two sentences (i.e. encapsulated belief). Lastly, they were asked to rate the degree of conviction of their encapsulated belief.

Phase 1: Cognitive restructuring

The therapists initiated the patients into a cognitive restructuring of their encapsulated belief by establishing a new perspective on their early traumatic memory. The patients were encouraged to examine the validity of their encapsulated belief by listing incongruent evidence. They were also encouraged to remember the results of behavioural experiments performed in previous CBT sessions. Through this process, the patients came to view an early traumatic memory in a more balanced way and understood that the memory was a time-limited experience without extensive implications for the present and the future.

Phase 2: Imagery rescripting

The therapists then initiated the patients into an imagery rescripting phase, which consisted of three stages:

Stage 1: The patients were asked to return to the age when they experienced the traumatic memory for the first time. They were asked to relive their memory as if the event was taking place here and now and to describe the scene of the memory in the present tense.

Stage 2: The patients were asked to explain the scene from a distant perspective, as if they were observing an event that occurred to a younger self. Within stage 2, the goal was to offer some form of intervention rather than just acting as a bystander. Thus, the goal was to create mastery imagery.

Stage 3: The patients were asked to relive the memory again, but this time as if the present adult self was accompanying the younger self. The adult self was encouraged to provide a new perspective on the traumatic memory that had been gained in Phase 1 (cognitive restructuring). The adult self was also encouraged to provide advice to the younger self as they were experiencing the traumatic event. Thus, the goal of stage 3 was to develop compassionate imagery.

When all procedures were completed, patients were asked how they felt. At the end of the imagery rescripting phase, the patients were asked to rate the vividness and distress of the image and the memory, respectively. They were also asked to rate the degree of conviction of their encapsulated belief.

All sessions including ImRs were audiotaped, and participants were encouraged to listen to the recordings as part of their homework.

Quality control

The CBT was delivered by eight therapists (six clinical psychologists and two psychiatrists) who were experienced in delivering CBT for PD. To confirm all therapists' adherence to

the protocol and assist with the planning of future sessions for each treatment, all therapists attended weekly group supervision sessions with other therapists and a senior supervisor (E.S.). The senior supervisor also checked the quality of the CBT delivered by the therapists using the Cognitive Therapy Scale-Revised (Blackburn *et al.*, 2001).

Measures

(1) Outcome measure of the whole CBT

The outcome measure of our CBT program was the self-reported severity of PD, as measured by the Panic Disorder Severity Scale (PDSS) (Shear *et al.*, 2001). The self-report form of the PDSS (Houck *et al.*, 2002) measures the severity of PD on a 5-point Likert-type scale ranging from 0 (*not severe*) to 4 (*severe*); higher scores indicate more severe PD. This scale was adapted from the original, clinician-administered scale (Shear *et al.*, 2001); it is the most frequently used scale for the assessment of PD. The interpretation of the PDSS total score (Furukawa *et al.*, 2009) differed according to the presence or absence of agoraphobia. When the patients were not agoraphobic, score ranges 0–1 corresponded to 'normal', 2–5 with 'borderline', 6–9 with 'slightly ill', 10–13 with 'moderately ill', and 14 and above with 'markedly ill'. When the patients were agoraphobic, score ranges 3–7 meant 'borderline', 8–10 'slightly ill', 11–15 'moderately ill', and 16 and above 'markedly ill'. The Japanese version of the PDSS was developed by Katagami (2007). Other measures used are shown in Seki *et al.* (2016). The PDSS (and all measurements in the study of Seki *et al.*, 2016) were conducted before the first session (at week 0; pre-CBT), after the eighth session (week 8; mid-CBT), and after the final session (week 16; post-CBT).

(2) ImRs ratings

Imagery and memory ratings (vividness and distress). As described in the ImRs procedure (Wild *et al.*, 2008), patients were asked how vivid an image recurrent in panic situations was on a scale ranging from 0 (*not at all*) to 100 (*extremely*). They were also asked how distressing the image was on the same scale. The vividness and distress of the early traumatic memory linked to a recurrent image were also rated in the same way.

Encapsulated belief rating. Patients were asked to summarize the meanings of an image that was recurrent in panic situations and related early traumatic memory in one or two sentences as an encapsulated belief. They were then asked to rate how much they believed this statement to be true, on a scale ranging from 0 (*not at all*) to 100 (*extremely*). All ImRs ratings were conducted prior to and after the ImRs session.

Statistical analysis

All statistical tests were two-tailed, and an alpha level of .05 was employed. All data were analysed using SPSS for Windows version 23 (SPSS Inc., Chicago, IL, USA). The outcomes of the CBT for PD were quantified as follows. First, regarding the outcome of our entire CBT program (PDSS scores), we analysed changes between pre-CBT and the other two time points (mid-CBT and post-CBT) using repeated measures, within-subjects analyses of variance (ANOVAs). We performed a non-parametric Wilcoxon signed rank test to compare pre- and post-ImRs ratings, because they were not normally distributed. The effect size ($\gamma = Z/\sqrt{2n}$)

was also calculated for changes in each ImRs rating (Field, 2009). According to Cohen (Cohen, 1992), the effect size of the correlation coefficient is categorized as follows: small (0.10–0.29), medium (0.30–0.49) and large (0.50 and above). Finally, we performed a paired *t*-test to determine the correlation between the value obtained by subtracting the post-PDSS score from the pre-PDSS score and the amount of change in each ImRs rating, as these data were normally distributed.

Results

The characteristics of the participants are given in Table 1.

For images repeatedly appearing in panic situations, 12 (80%) patients had images of symptoms of panic attacks, four (27%) patients had images of anticipatory anxiety, six (40%) patients had spatial images (being in a closed space, in a train, at a station, in a dark place, in a large space), and four (27%) patients had images of loneliness (being understood by no one, being alone, being in a place without acquaintances). Of note, one patient may have had multiple images.

Regarding the initial traumatic memory associated with the recurrent images, nine (60%) patients had a memory of the first panic attack, two (13%) patients had a memory of other panic attacks (one patient had a memory of a second panic attack, another of a feeling experienced as a child that was similar to the current feeling of panic attacks), and four (27%) patients had memories of events other than panic attacks (absent from school due to vomiting for weeks, seeing my mother suffering from cancer, being misunderstood by a teacher and running away from school, and being criticized by my mother at a party).

Table 2 gives details of individual patients in ImRs.

Table 3 shows themes commonly observed in the worst meaning of images, the worst meaning of memory, and encapsulated beliefs. Self-negative contents not directly related to panic attack were observed in ImRs. Among these, the five representative themes were as follows: 'being worthless', 'being helpless', 'being lonely', 'bothering others', and 'showing embarrassing behaviour in public'.

Table 4 shows pre- and post-scores for ImRs ratings. ImRs significantly reduced distress from images, memories and encapsulated beliefs; however, it did not change the vividness of images and memories. The effect sizes on distress of image, distress of memory, and conviction degree of encapsulated belief were 0.55 (large), 0.43 (medium), and 0.55 (large), respectively. Although the participants in our study were partially different from those in the study of Seki *et al.* (2016), we obtained a similar result (i.e. a significant reduction in PDSS score). The mean total PDSS score decreased from 13.1±4.8 at pre-CBT to 8.2±4.7 at mid-CBT and to 6.1±5.0 at post-CBT. A repeated measures ANOVA revealed a significant main effect of time point on the PDSS total score: $F(2,28) = 28.9$, $p < .001$; however, there was no significant correlation between the value obtained by subtracting the post-PDSS score from pre-PDSS score and the change amount in each ImRs rating (data not shown). Follow-up data after 1 year were obtained from 10 of 15 patients, and the mean total PDSS score was 5.4±3.1.

Discussion

This study was the first attempt to apply ImRs to PD. We obtained the following results for images, memories, beliefs, and the effect of ImRs on patients with PD. All patients had

Table 2. *Details of individual patients in imagery rescripting*

P	Recurrent image in panic situations	Worst meanings of image	Memory linked to image	Worst meanings of memory	Encapsulated belief
a	A fear image in which a panic attack occurs under confined situation. There is no one who understands my situation	I expose the disgraceful behaviour in public. I feel miserable and others feel disgusted with me	I felt intense nausea in a limited express train. With a feeling of irresistible fear, I had the illusion that the attention of others was directed at me	Hopelessness, helplessness with no-one to rely on. As long as I endure suffering, I will not annoy anyone	Do not let other people feel bad, do not bother others. I should not act in disgrace. I can only depend on myself. I must have a strong sense of responsibility
b	A person lying on his back in a dark place within a large place	I will soon die. I seek help, but neither I nor anyone around me can do anything	Two years ago, at the Stadium fireworks festival, I had heart palpitations and sat down	I wonder if I am going to die now	I am alone. I cannot deal with myself
c	My heart is pounding. I wonder if I do not have to go to the toilet	If I were incontinent in public, it is very scary	It was 19 years ago, in a plane going on a Korean trip with a family, coming in to land	I cannot behave freely after having fun. I am annoying my husband	I do not know why the bad feeling happened. I do not know what the cause is and I cannot help it
d	For a moment, the front of me is getting dark. After that I am standing alone in the dark	I have trouble in the workplace and in my surroundings. Alone and despair. I cannot do anything by myself	Seven years ago, I got a job for the first time but my physical condition got worse. I quit my job at last but could hardly find my next job. I made my family worry	I cannot live by myself when my parents are dead	I cannot live by myself. I cannot work because I am socially isolated and have become useless. I am an annoying person who cannot do anything alone

Table 2. *Continued*

P	Recurrent image in panic situations	Worst meanings of image	Memory linked to image	Worst meanings of memory	Encapsulated belief
e	Feeling that my back is sinking (like going down on a roller coaster).	I cannot go home. What should I do?	When I was a kindergarten student, I was sitting on a child's chair at the table. I had a feeling of sinking (like going down on a roller coaster) almost every day	I cannot take the balance of the body. I do not know whether my body is shaking. I cannot keep my mind normal. I go crazy	I go insane with fear and dizziness
f	It is hot and stuffy and I want some water but I cannot drink it	I will fall down because I am dehydrated, and my falling down will bother people	When I was in the airport in Macau, the seats were narrow and cramped. I want to go outside and get some fresh air. I did not have any drinks	I cannot breathe. I fall down in hyperventilation and feel embarrassed	If I feel stuffy, I will be overwhelmed with hyperventilation and go insane
g	On the train, I am alone in a space where I cannot exit. I have numbness in my limbs. I am afraid and uncomfortable. I feel that my surroundings do not care about me	I am weak in spirit and physical strength. I cannot arrive at my destination. I cannot live by myself. I will be alone if my parents are dead	When I was in elementary school, I was absent from school for two weeks with nausea, with a full feeling in my throat, fear of vomiting	I want to escape from suffering, but I cannot run away. I do not know how to live. I want someone to help me but I am suffering only by myself	I cannot escape from suffering. I cannot live. Others cannot understand me. I am alone
h	My heartbeats will turn into myocardial infarction	I will have a myocardial infarction	One night a little bit after my parents died, I stayed in bed and it became stuffy	I will collapse due to heart disease	When the palpitations start, they get stronger and stronger, and I fall down due to my heart

Table 2. *Continued*

P	Recurrent image in panic situations	Worst meanings of image	Memory linked to image	Worst meanings of memory	Encapsulated belief
i	I am suffering from an overwhelming stroke. I am in pain. I cannot breathe. I am sweating	I press the emergency button to escape, open the door and get out. I make a fuss	Over 20 years ago, in a very crowded train. It was rainy and humid. I was suddenly suffocating. I became scared, pushed through the crowd and hit the doors of the conductor's booth, saying, 'Please help me!'	I am very ashamed	Panic disorder picks people. The chosen person has serious flaws
j	The collapse of my heart	My heart stops	Thirteen years ago, my mother was in the end stages of cancer and I saw her suffering in the hospital	I should have been able to do something more	I needed to do something more, but I did not do it
k	I am conscious only of myself, blocked from the outside	Air is not enough. I'm almost screaming with scare. I will not be able to take my breath	When I was conscious of breathing in the washroom, I became more and more concerned about it	I cannot breathe. I will die by suffocation	I cannot breathe. I will collapse and die
l	I am suffering from unnatural breathing. The people around me are strangers. They see me as a strange person with unnatural breathing	I suffer from my breathing. I collapse and nobody helps me. I will lose consciousness and die in this way	When I was a high school student, my heart palpitated; I could not stay calm. The health teacher asked me what was wrong, but I myself did not know what happened and I could not explain it well	Others understand hyperventilation when seen from the outside. But they do not know the panic feeling, so I cannot get help. My hyperventilation is different from that of others, so it will not heal	Even though I did CBT, I had a relapse. It may also recur. I will never be cured for life. I cannot fulfil my responsibility as the family's breadwinner

Table 2. *Continued*

P	Recurrent image in panic situations	Worst meanings of image	Memory linked to image	Worst meanings of memory	Encapsulated belief
m	Image that is to anxiety on the train. My hands are rigid and I felt my body was dying	Because of suffering to the extent of death, I act abnormally enough to make myself funny to others. I harm people. I get crazy	Two years ago, when I was on a train, a panic attack occurred. My blood rose at the moment and my consciousness was on the brink of being lost	I am afraid to get on the train and it is impossible. I cannot do my best any longer. Exposure to the train is impossible now	The train is scary. It is impossible to get on
n	A sense of fear and anxiety comes up all at once. Suddenly fear comes out. There is no place to escape, only to endure	I am afraid of panic attacks. I am afraid to bound by the sense of fear. I want to meet my parents' expectations but panic prevents it. I want to be cured, but it is not going well	About ten years ago, during a party, my mother kept blaming me loudly. She also told me 'There is no such cruel child like you'	My mother breaks everything. My mother breaks the people and things that I care about	My mother breaks people and things precious to me at her convenience
o	A stretcher, a wheelchair. There are four to five station staff. I guess others will be late	I am sorry to disturb others. I am taking extra care. It is bad though it is a simple panic attack. Although it is not a big deal, I am annoying others	When I was in the fourth grade of elementary school, my teacher misunderstood me as being rebellious and ordered me to go home. I left school and hid in the house of my grandmother. My mother was very worried and protested to my teacher in tears	I did not solve my problem when I had it, causing inconvenience to people	In a trivial matter such as panic, I am annoying people. I did not do what I had to do. I did something I should not do. I worried my mother

Table 3. *Themes in the meaning of images and memories, encapsulated beliefs (N = 15)*

	Worst meanings of		
Theme	Recurrent images (*n*)	Traumatic events (*n*)	Encapsulated beliefs (*n*)
Anticipatory anxiety	9	6	5
Being useless or worthless	2	1	4
Being powerless, unable to live alone	4	4	4
Being lonely, not understood or without help	3	3	4
Bothering others	4	2	4
Showing embarrassing behaviour in public	4	0	1
Being ashamed	0	2	0
PD is never cured/the cause of PD is unknown	0	1	2
My life is not going well/life is hopeless	2	1	1
Being damaged by my parent(s)	0	2	1
I must have a strong sense of responsibility	0	0	1

Note: One patient may have multiple meanings and beliefs. PD, panic disorder.

Table 4. *Pre- and post-ImRs ratings (N = 15)*

	Pre-ImRs	Post-ImRs	Analysis		
ImRs ratings	Median (IQR)	Median (IQR)	*Z*	*p*	*r*
Image vividness	77.5 (27.5–97.5)	70.0 (50.0–100)	−0.071	.94	0.014
Image distress	87.5 (67.5–100)	55.0 (30.0–70.0)	−2.92	.004**	0.55
Memory vividness	80.0 (60.0–100)	70.0 (50.0–100)	−0.94	.35	0.18
Memory distress	80.0 (40.0–100)	40.0 (30.0–85.0)	−2.36	.018*	0.43
Encapsulated belief	90.0 (50.0–100)	60.0 (23.8–80.0)	−2.91	.004**	0.55

ImRs, imagery rescripting; IQR, interquartile range; *r*, effect size; *p* < .05, **p < .01.

recurrent images in panic situations. Among the images that the patients had were an image of symptoms of panic attacks, anticipatory anxiety, an image of being confined in a closed space, and an image of loneliness. The spatial image seemed related to agoraphobia; however, the loneliness images are not necessarily related to panic attacks.

The meanings of image, memory and encapsulated beliefs were idiosyncratic and patient specific, relating to individual trauma experiences. However, self-negative contents not directly related to symptoms of panic attack were observed as common themes beyond the differences of individual patients. These themes may be related to the persistence of panic symptoms by controlling patients' thoughts and indirectly affecting emotion, behaviour and body sensation. Depression and SAD are known to often be co-morbid with PD; among the themes observed in ImRs, the self-negative contents of being worthless, being helpless and being lonely may be involved in depression. Those of bothering others and showing embarrassing behaviour in public may be seen within SAD. The process of treating such themes is not included in conventional CBT for PD. Therefore, it is considered clinically meaningful to add ImRs sessions to conventional CBT.

ImRs significantly reduced the distress of images and memories. Even though these did not lead to the creation of new functional beliefs, the confidence of maladaptive beliefs was decreased. However, it did not change the vividness of images and memories. This result suggests that the series of processes of ImRs alleviated the pain of traumatic memory and corrected the non-functional and biased beliefs derived from the memory. As these images and memories were evoked during ImRs, it is natural that the vividness of the image and the memory did not decrease after ImRs.

We assumed that the correlation between changes in PDSS scores and changes in encapsulated beliefs would reflect mechanisms of change. Contrary to our expectation, there was no significant correlation between the reduction in the severity of the PD (as measured by PDSS) over the course of the whole CBT program and the change in each ImRs rating. The CBT conducted in this study included other sessions than ImRs. While ImRs session were placed in the second half of the CBT, the change in the PDSS score was larger in the amount of change from pre- to mid-treatment than from mid- to post-treatment. Improvement at the symptomatic level of PD seems to be mostly obtained in the first half of CBT. The first half of the CBT included conventional CBT components such as behavioural experiments on the presence or absence of safety behaviours and catastrophic self-image reconstruction, resulting from the misinterpretations of bodily sensations. These sessions are considered to sufficiently alleviate the symptoms of PD.

To date, several authors have specifically written about proposed mechanisms of change in ImRs. For example, Arntz suggested that ImRs is a psychological means to change the original memory and the content of the memory-related working selves (e.g. Arntz and Weertman, 1999; Arntz, 2011). Others have suggested that individuals have different self-representations that are activated in response to memory recall, and whose accessibility may be modified as a result of ImRs (e.g. Brewin, 2006; Brewin *et al.*, 2009; Çili *et al.*, 2017). However, based on the results of this study, it is not possible to suggest how probable mechanisms of ImRs are. Mechanisms aside, the question of the role of ImRs in the treatment of PD remains. Two studies suggest an answer to the question. Long *et al.* (2011b) analysed data from ImRs performed in the treatment of post-traumatic nightmares (PTNMs), suggesting that modification of post-traumatic cognitions is a mechanism of change when using a manualized PTNM ImRs intervention, and ImRs may bring about a long-term improvement in trauma-related cognitions. Veale *et al.* (2015) performed a single ImRs on patients with OCD. They found that the score of the Yale-Brown Obsessive Compulsive Scale was even lower after 3 months than immediately after ImRs. These studies suggest that ImRs plays an important role in maintaining the long-term stability of a panic-free state, recovery from post-traumatic symptoms, and the prevention of recurrence. In our study, remission of PD has been maintained in 10 out of 15 patients based on follow-up data. However, as to whether ImRs contributes to maintenance of remission, evaluation (such as re-measurement of ImRs ratings) is necessary.

Limitations

The limitations of this study include the following: no control group was set, the sample size was small, there was a large sex bias among participants, and there was a lack of follow-up data on ImRs ratings. Further investigation is required for the effectiveness of ImRs for PD. It is ultimately necessary to deal with the subject of this research in a randomized controlled

trial that gathers larger, more diverse samples, devises a follow-up period, and is performed at multiple institutions. Further refinement will be necessary for the cognitive model of PD, which is the basis of the effectiveness of ImRs. Furthermore, ImRs is not mandatory for all patients with PD. Even using conventional CBT without ImRs, many patients recover. Therefore, it is necessary to develop a method to predict what PD patients need ImRs.

Main points

(1) This study explored the therapeutic effects of ImRs on patients with PD to change the meaning of images and associated memories and reduce emotional distress.
(2) ImRs significantly reduced distress from images, memories and encapsulated beliefs; however, it did not change the vividness of images and memories.
(3) There was no significant correlation between the reduction in PD severity over the CBT program and the change in each rating (vividness and distress of the images and memories and conviction degree of encapsulated beliefs) in ImRs.

Conflicts of interest

Takayuki Shibuya, Yoichi Seki, Shinobu Nagata, Tomokazu Murata, Yoichi Hiramatsu, Fuminori Yamada, Mizue Yokoo, Hanae Ibuki, Noriko Minamitani, Mari Tanaka and Eiji Shimizu have no conflicts of interest with respect to this publication.

Ethical statements

The present paper followed the Ethical Principles of Psychologists and Code of Conduct as set out by the American Psychiatric Association. The Ethics Committee of the Chiba University Graduate School of Medicine approved the study protocol (reference number 1710).

Recommended follow-up reading

Arntz A (2012). Imagery rescripting as a therapeutic technique: review of clinical trials, basic studies, and research agenda. *Journal of Experimental Psychopathology* **3**, 189–208.

Reimer SG, Moscovitch DA (2015). The impact of imagery rescripting on memory appraisals and core beliefs in social anxiety disorder. *Behaviour Research and Therapy*, **75**, 48–59.

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Learning objectives

(1) To understand the procedure of ImRs in CBT for PD.
(2) To recognize that some patients with PD have self-negative contents not directly related to symptoms of panic attacks as common themes in the worst meaning of the image, the memory, and in the encapsulated belief.
(3) To appreciate that ImRs might be potentially effective in treating some patients with PD.