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DOI
10.1080/20008066.2024.2397890

Publication date
2024

Document Version
Final published version

Published in
European Journal of Psychotraumatology

EUROPEAN JOURNAL OF PSYCHOTRAUMATOLOGY
2024, VOL. 15, NO. 1, 2397890
https://doi.org/10.1080/20008066.2024.2397890

CLINICAL RESEARCH ARTICLE

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Childhood-related PTSD: the role of cognitions in EMDR and imagery rescripting

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ABSTRACT

Background: The relationship between trauma-related negative cognitions and post-traumatic stress disorder (PTSD) symptoms has been studied frequently. Several studies found a mediating effect of trauma-related negative cognitions on symptom reduction in studies on different psychotherapeutic treatments, however, this relationship has never been studied in imagery rescripting (ImRs) or eye movement desensitization and reprocessing (EMDR).
Objective: To analyse the role of trauma-related negative cognitions in the treatment of PTSD due to childhood trauma with EMDR and ImRs.
Method: $N = 155$ patients with PTSD due to childhood trauma aged between 18 and 65 ($M = 38.54$) participated in a randomized clinical trial and were treated with either EMDR or ImRs in Australia, Germany, and the Netherlands between October 2014 and June 2019. We analysed the relationship between PTSD symptoms (Clinician-administered PTSD Scale for DSM-5, CAPS-5 and Impact of Event Scale revised; IES-R, completed twice for index trauma and for all other traumas) and trauma-related negative cognitions (Post-Traumatic Cognitions Inventory, PTCI) using Granger Causality analyses with linear mixed models on person-centered variables. Assessments were conducted pre-treatment, post-treatment (12 sessions in 6 weeks), eight weeks post-treatment, and one year after the pre-treatment assessment.
Results: Changes in negative cognitions (PTCI) preceded changes in PTSD symptoms (unidirectional) as measured by the CAPS and the IES-R for index trauma. For the IES-R related to all other traumas, a unidirectional relationship was found in which changes in PTSD symptoms preceded changes in negative cognitions. No moderating effect of treatment was found. On the level of PTCI subscales only changes in cognitions about oneself preceeded changes in PTSD symptoms.
Conclusions: The results support the idea of a general role of trauma-related negative cognitions in the treatment of PTSD. The analyses should be replicated with a higher frequency of assessments.

TEPT relacionado con la infancia: el papel de las cogniciones en EMDR y la reescritura con imágenes

Antecedentes: La relación entre las cogniciones negativas relacionadas con el trauma y los síntomas del trastorno de estrés postraumático (TEPT) se ha estudiado con frecuencia. Varios estudios han encontrado un efecto mediador de las cogniciones negativas relacionadas con el trauma en la reducción de los síntomas en estudios sobre diferentes tratamientos psicoterapéuticos, sin embargo, esta relación nunca se ha estudiado en la reescritura con imágenes (ImRs por sus siglas en ingles) o en la desensibilización y reprocesamiento por movimientos oculares (EMDR).
Objetivo: Analizar el papel de las cogniciones negativas relacionadas con el trauma en el tratamiento del TEPT por trauma infantil con EMDR e ImRs.
Método: $N = 155$ pacientes con TEPT debido a trauma infantil de entre 18 y 65 años ($M = 38.54$) participaron en un ensayo clínico aleatorizado y fueron tratados con EMDR o ImRs en Australia, Alemania y los Países Bajos entre octubre de 2014 y junio de 2019. Se analizó la relación entre los síntomas de TEPT (Escala de TEPT administrada por el clínico del DSM-5, CAPS-5 y la Escala de Impacto del Evento revisada; IES-R, completada dos veces para el trauma índice y para todos los demás traumas) y las cogniciones negativas relacionadas con el trauma (Inventario de Cogniciones Postraumáticas, PTCI) utilizando análisis de causalidad de Granger con modelos lineales mixtos sobre variables centradas en la persona. Se realizaron evaluaciones

ARTICLE HISTORY
Received 23 May 2024
Revised 18 July 2024
Accepted 9 August 2024

KEYWORDS
Post-traumatic stress disorder; negative cognitions; psychotherapy; EMDR; imagery rescripting; childhood trauma

PALABRAS CLAVE
Trastorno de estrés postraumático; cogniciones negativas; psicoterapia; EMDR; reescritura con imágenes; trauma infantil

Highlights

- We studied the role of trauma-related negative cognitions in the treatment of post-traumatic stress disorder (PTSD) with either EMDR or ImRs.
- Within-person changes in trauma-related negative cognitions preceded changes in PTSD symptoms, except for self-reported PTSD symptoms of all other trauma's than the index trauma, where the opposite relationship was found.
- We found no moderation by treatment condition, this supports the idea of a general role of trauma-related negative cognitions in the treatment of post-traumatic stress disorder.

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pretratamiento, postratamiento (12 sesiones en 6 semanas), ocho semanas postratamiento y un año después de la evaluación pretratamiento.
Resultados: Los cambios en las cogniciones negativas (PTCI) precedieron a los cambios en los síntomas de TEPT (unidireccional) medidos por el CAPS y el IES-R para el trauma índice. Para la IES-R relacionado con todos los demás traumas, se encontró una relación unidireccional en la que los cambios en los síntomas de TEPT precedieron a los cambios en las cogniciones negativas. No se encontró ningún efecto moderador del tratamiento.
Conclusiones: Los resultados apoyan la idea de un papel general de las cogniciones negativas relacionadas con el trauma en el tratamiento del TEPT. Los análisis deberían repetirse con una mayor frecuencia de evaluaciones.

1. Background

Trauma-related negative cognitions are a central part of post-traumatic stress disorder (PTSD) and are included in the diagnostic criteria of PTSD in the DSM-5 (American Psychiatric Association, 2013; Kip et al., 2023). These negative cognitions can be related to oneself (e.g. 'I am damaged'), others (e.g. 'No one can be trusted') or the world (e.g. 'The world is dangerous'). Explanatory models of different therapeutic approaches (e.g. cognitive therapy [CT], cognitive behavioural therapy [CBT], prolonged exposure [PE], eye movement desensitization and reprocessing [EMDR]) see these cognitions as important factors that maintain PTSD symptoms (Ehlers & Clark, 2000; Foa & Kozak, 1986; Resick et al., 2016; Shapiro & Forrest, 2001). Indeed, the association between trauma-related negative cognitions and PTSD symptoms was found in several studies (overview in Gómez de La Cuesta et al., 2019).

It seems likely that negative cognitions also play an important role in PTSD treatment. Although only some therapeutic approaches directly focus on trauma-related negative cognitions, there seems to be a general relationship between these cognitions and PTSD symptoms (Kangaslampi & Peltonen, 2022). A recent review on the role of trauma-related negative cognitions in the treatment of PTSD reported that several studies found a concurrent reduction of PTSD symptoms and negative cognitions independently from the therapeutic approach (Brown et al., 2019). An important question is whether the reduction in trauma-related negative cognitions and PTSD symptoms simply co-occur during treatment or whether the reduction in trauma-related negative cognitions precedes the reduction of PTSD symptoms. Several studies on that question are also summarized in a review (Brown et al., 2019) reporting that nine of twelve studies found that changes in trauma-related negative cognitions preceded changes in the PTSD symptoms. In addition, two recent studies not included in the review also found that changes in trauma-related negative cognitions preceded symptom reduction (Kooistra et al., 2023; Schumm et al., 2023). On the other hand, a total of six studies (those before 2019 included in Brown et al., 2019) did not find the assumed relationship between PTSD symptoms and negative cognitions, but instead found a bidirectional relationship (Dillon et al., 2019; Held et al., 2022; McLean et al., 2015; Trachik et al., 2018), a simultaneous reduction of symptoms and cognitions (Lee et al., 2021) and a reversed relationship (changes in PTSD symptoms preceding changes in negative cognitions) (Hagenaars et al., 2010). Thus, findings are mixed, although the majority of studies point to changes in trauma-related negative cognitions preceding changes in PTSD symptoms.

One study found a reciprocal relationship was based on a comorbid (alcohol dependency) sample which might explain the result. Another possible explanation for the contradicting results might be the operationalization of trauma-related cognitions. For instance guilt (Trachik et al., 2018) and blame (Dillon et al., 2019) captured narrowly defined trauma-associated cognitions compared to a broader definition that is used for the Posttraumatic Cognitions Inventory (PTCI) (Foa et al., 1999), which includes the subscales self, world and self-blame. The PTCI was used in many studies on trauma-related negative cognitions. Studies analysing trauma-related negative cognitions on the level of PTCI subscales found differences between the subscales in their association with PTSD symptoms (overview in Brown et al., 2019). Correlation studies found a strong cross-sectional association between self-related negative cognitions and PTSD symptoms or symptom reduction (Foa & Rauch, 2004; Karl et al., 2009; Long et al., 2011). Two out of three studies examining the relationship between specific trauma-related cognitions and PTSD symptom change over time found that cognitions related to oneself were relevant predictors of change in PTSD symptoms over time (Kumpula et al., 2017; Schumm et al., 2015) whereas one study found a stronge relationship between self-related cognitions and PTSD symptoms, but changes in cognitions did not predict symptom changes (Hagenaars et al., 2010). However, especially trauma-related negative cognitions related to oneself might be a relevant predictor for changes in PTSD symptoms (Brown et al., 2019). This is also in line with recent findings on the effectiveness of PTSD treatment in reducing a negative self-concept (Banz et al., 2022).

Even though there is mixed evidence for change in trauma-related negative cognitions preceding change in PTSD-symptoms, the fact that such an effect was found in cognitive therapy as well as in exposure-based therapy might be an indication for a general change mechanism that is not unique to specific (cognitive) therapeutic approaches. To investigate this assumption further, it is important to analyze the role of trauma-related negative cognitions in various PTSD treatments. One treatment that has been shown to be effective and is next to CBT as highly recommended for the treatment of PTSD is EMDR (Lewis et al., 2020; Mavranezouli et al., 2020). Another promising treatment is Imagery Rescripting (ImRs) (Arntz & Weertman, 1999), which has some evidence for its effectiveness in the treatment of PTSD in general (see meta-analysis from Kip et al., 2023) and for PTSD from childhood trauma in particular (Boterhoven de Haan et al., 2020; Raabe et al., 2022). In EMDR, trauma-related negative beliefs are directly targeted and after desensitization, the therapist repeatedly pairs positive beliefs to the memory of the trauma (Shapiro & Forrest, 2001). ImRs addresses trauma-related negative cognitions more indirectly by imagery of corrective experiences, meeting of needs, and changing the meaning of an event by psychoeducation. Thus, both therapeutic approaches aim to address and change trauma-related negative cognitions in different ways and might differ regarding the effect of changes in cognitions on PTSD symptoms. An earlier analysis on the working mechanisms of ImRs and EMDR using the same data set as our study found that changes in distress and idiosyncratic encapsulated belief related to the index trauma predicted changes in PTSD severity during ImRs, but not EMDR (Rameckers et al., 2024). Some studies showed a simultaneous reduction of negative trauma-related cognitions and PTSD symptoms from pre to post EMDR treatment (Brown et al., 2019).

To our knowledge until now no study investigated the effect of general trauma-related negative cognitions (e.g. measured by the PTCI) on the treatment outcome of EMDR or ImRs. To learn about the role of (general) trauma-related negative cognitions in ImRs and EMDR treatment we analyzed the time order of changes in trauma-related negative cognitions and PTSD symptoms, using data from a randomized trial comparing EMDR and ImRs as treatments of PTSD from childhood trauma (Boterhoven de Haan et al., 2020) using Granger causality analysis (Granger, 1969). This analysis allows an examination of the time-lagged relationships between variables and provides insight into the directionally of changes in negative cognitions and PTSD symptoms. We (i) hypothesize that changes in trauma-related negative cognitions precede changes in PTSD symptoms and thus give some evidence for a mechanism of change. Additionally, we explored whether the effects are moderated by treatment condition. Given the findings on self-related negative cognitions, it is (ii) hypothesized that only changes in this subscale precede changes in PTSD symptoms.

2. Methods

2.1. Study design

The present study is a sub-analysis of the data from an international multicentre randomized clinical trial (IREM-RCT) comparing EMDR and ImRs in seven sites in Australia, Germany, and the Netherlands (Boterhoven de Haan et al., 2020). The trial was registered on the Australian and New Zealand Clinical Trials Registry (ref no. ACTRN12614000750684). The study was approved by all local institutional review boards and patients provided written informed consent. Detailed information about study characteristics can be found in the IREM design article (Boterhoven de Haan et al., 2017), the following is a brief description of the study design.

2.2. Participants

Patients were included if they (1) had a primary diagnosis of PTSD based on an index trauma before the age of 16 with symptoms for at least three months, (2) were aged between 18 and 65 years, (3) were able to attend sessions twice a week, and (4) agree to stay on stable medication (or no medication) during the treatment phase of six weeks and the eight-week follow-up phase. Exclusion criteria were (1) an acute suicide risk, (2) lifetime diagnosis of psychotic disorder, (3) lifetime diagnosis of bipolar disorder type 1, (4) an acute substance dependence, (5) a PTSD from trauma occurring within the past six months, (7) an IQ below 80, (8) any PTSD-focused therapy within the past three months, and (9) benzodiazepine medication. Participation was possible after two weeks of abstinence of this medication.

2.3. Randomization and masking

Participants were randomized to either EMDR or ImRs after pre-treatment assessment by an independent research assistant using block randomization (n = two, four, and six per block, with block size randomized) and stratifying for gender to control distribution per treatment at each site. All assessments were conducted by trained research assistants blind to treatment condition.

2.4. Procedures

Between October 2014 and June 2019, participants were recruited at seven mental health and specialized services across Australia, Germany, and the Netherlands. Depending on site preferences potential participants were screened for psychiatric disorders using the Mini International Neuropsychiatric Interview (Sheehan et al., 1998) or the Structured Clinical Interviews for DSM-IV-TR (First et al., 2002) because the Structured Clinical Interview for DSM-5 (First et al., 2015) was not available at the beginning of the study. Trauma history was assessed using the Life Events Checklist for DSM-5 (Weathers et al., 2013). Outcome assessments were conducted pre-treatment, mid-treatment (only self-rating, no interview) post-treatment, eight weeks post-treatment (follow-up 1), and one year after the pre-treatment assessment (follow-up 2).

2.5. Outcomes

PTSD symptom severity was measured by the clinician-administered PTSD Scale for DSM-5 (CAPS-5) (Weathers et al., 2018). The CAPS-5 is a well validated semi-structured diagnostic interview to assess severity of PTSD symptoms over the previous month. It consists of 30 items, corresponding to the DSM-5 PTSD symptoms and rates the severity of PTSD within a range of 0–80 (total score, higher scores reflecting greater severity) over the last month. For our analysis the criterion D2 and D3 were excluded from the CAPS total score because they assess negative cognitions and feelings of guilt, and therefore have an overlap with the items of the PTCI. The internal consistency of these CAPS scores for each assessment fell between $a = .892$ and 922. Self-report of PTSD symptoms was measured by the Impact of Events Scale-Revised (IES-R) (Weiss, 2007). The IES-R consists of 22 items rated for the last seven days and is sensitive to change. Participants were asked to rate the items twice, once for the trauma identified as central at intake (index trauma) (a between .877 and .972) and then again for all other traumas except the index trauma (a between .927 and .973). The Post-Traumatic Cognitions Inventory (PTCI) was used to assess trauma-related cognitions (Foa et al., 1999). The PTCI is a 33-item self-report instrument with three subscales (negative cognitions about oneself, negative cognitions about the world, and self-blame) with good psychometric characteristics and is frequently used in studies on trauma-related negative cognitions. We analyzed the PTCI total score as well as the three subscales. Based on our data, the internal consistency of the PTCI total score was high/excellent, with an a between .928 and .978. The internal consistency of the three subscales on the different assessments was also high (For the PTCI-Self scale, between $a = .919$ and .973, for the PTCI-World scale a between .850 and .964, for the PCTI self-blame scale between .802 and .935).

To limit the number of analyses we only used the primary outcome (CAPS) to analyse the PTCI subscales.

2.6. Treatment

Briefly, the study treatment consisted of twelve 90-min sessions of either ImRs or EMDR, twice a week, for a period of six weeks with up to eight weeks permitted based on standardized treatment manuals (Arntz & Weertman, 1999; Shapiro & Forrest, 2001). The first session included an introduction to the treatment rational and the creation of an overview of trauma memories to be addressed during treatment. In the ImRs condition, a pilot rescripting was conducted and in the EMDR condition procedural preparation and affect tolerance training including a safe place exercise was conducted. From treatment session two onwards, each session required trauma reprocessing in the allocated treatment condition. Study therapists were licensed psychologists, psychotherapists, psychiatrists, and one psychiatric nurse with advanced mental health qualifications trained in one or both treatment conditions. Details on treatment, training, supervision, and adherence can also be found in the study protocol and the publication on clinical effectiveness from the IREM trial (Boterhoven de Haan et al., 2017; Boterhoven de Haan et al., 2020).

2.7. Statistical analysis

We conducted Granger Causality (Granger, 1969) analyses with linear mixed models to examine the relationships between the PTCI and PTSD symptoms over time. We conducted the analyses in R studio with the NLME package (Pinheiro et al., 2020). For each PTSD measure (i.e. IES-R Index trauma, IES-R All other traumas, and the CAPS-5) we conducted separate analyses. First, we centred the data at the participant level. Second, we examined if the PTCI scores at assessment i predicted PTSD symptoms at assessment $i + 1$, whilst also including the PTSD symptoms at assessment i as predictor, to control for autocorrelation. We tested the reverse effects by examining if CAPS-5 scores at assessment i predicted PTCI scores at assessment $i + 1$. As changes over time can also occur due to unspecific treatment effects and as we expected a non-linear time trend, we controlled for the effect of time by adding a natural spline of time with two degrees of freedom using the splines package (R Core Team, 2020). Lastly, we also added a random effect of time (using the same splines) if this improved model fit.

All model comparisons were based on the loglikelihood, the Bayesian Information Criterion (BIC), and Akaike Information Criterion (AIC). The alpha cut-off for all analyses was .05. We defined outliers as residuals with an absolute value larger than 3 (Blatná, 2006). In case any outliers were detected, these were removed, and the number of outliers removed was reported. In the results section, the results based on the data excluding outliers is reported. The correlation (r) between each fixed predictor and the outcome variable was calculated: $r = \sqrt{\left(\frac{t^2}{t^2 + df}\right)}$. We also calculated Cohen's d using the following formula: $d = \frac{2 * t}{\sqrt{df}}$. We inspected the influence of all datapoints by inspecting the Cooks' distance for each point. For each of the models, all Cook's distance values were small and fell under the 1 cut-off (Cook & Weisberg, 1982).

3. Results

3.1. Participants

The data from all participants who participated in the IREM study ($N = 155$) was included across three countries: the Netherlands ($n = 92$), Germany ($n = 22$) and Australia ($n = 41$). Participants were allocated to EMDR ($n = 81$) or ImRs ($n = 74$). The proportion of females was 77% and the average age of participants was 38.54 years. Most of the participants experienced their index trauma multiple times (93.2% ImRs, 79.0% EMDR participants), the mean duration of the index trauma was 7.6 (SD = 5.2) years for ImRs and 6.8 years (SD = 4.6) for EMDR. The most frequent index trauma was sexual abuse (48.6% ImRs, 67.9% EMDR), followed by physical abuse (20.3% ImRs and 19.8% EMDR) and the mean age at the time of index trauma was 7.77 years (SD = 4.21) for ImRs and 8.12 years (SD = 4.16) for EMDR. Most of the participants had tertiary/vocational education (56.8% both), but less than half of the participants was working (39.2% ImRs, 42.0% EMDR), and about one-third was on disability pension (37.9% ImRs and 32.0% EMDR). Further details on the study sample can be found in the primary publication of the IREM study (Boterhoven de Haan et al., 2020).

3.2. Granger causality

For the main analysis (see Table 1 and Figure 1a), we tested Granger causality for each of the three PTSD outcomes (i.e. CAPS-5, IES-R Index trauma, and IES-R Other trauma). Exploratory, we also examined the interactions with treatment. For all analyses, the

Table 1. Model outcomes from the granger causality models.

Model	b	β	t(df)	SE	df	p	95% CI	d	r
CAPS-5 predicted by PTCI total[a]									
CAPS-5	−0.468	-.485	−10.184	0.046	286	<.001	[−0.559, − 0.378]	−1.204	.516
PTCI	0.027	.085	2.074	0.013	286	.039	[0.001, 0.053]	0.245	.122
PTCI total predicted by CAPS-5 *Reverse*									
PTCI	−0.349	-.361	−10.806	0.032	289	<.001	[0.413, 0.286]	−1.271	.536
CAPS-5	0.149	.005	1.325	0.112	289	.186	[−0.072, 0.370]	0.156	.078
CAPS-5 predicted by PTCI negative cognitions oneself[b]									
CAPS-5	−0.410	-.424	−8.986	0.046	276	<.001	[−0.500, − 0.320]	−1.086	.477
PTCI self	1.395	.132	3.376	0.413	276	.001	[0.581, 2.208]	0.423	.207
PTCI negative cognitions oneself predicted by CAPS *Reverse*									
PTCI self	−0.362	-.373	−10.003	0.036	259	<.001	[−0.433, − 0.291]	−1.243	.528
CAPS-5	0.001	.015	0.354	0.004	259	.723	[−0.006, 0.009]	0.044	.022
CAPS-5 predicted by PTCI negative cognitions world[b]									
CAPS-5	−0.333	-.345	−7.925	0.042	276	<.001	[−0.416, − 0.251]	−0.954	.430
PTCI world	0.538	.058	1.635	0.329	276	.103	[−0.010, 0.187]	0.196	.098
PTCI negative cognitions world predicted by CAPS-5 *Reverse*[c]									
PTCI world	−0.328	-.323	−8.439	0.039	258	<.001	[−0.405, 0.252]	−1.051	.465
CAPS-5	0.018	.170	3.718	0.005	258	<.001	[0.009, 0.028]	0.463	.226
CAPS-5 predicted by PTCI self-blame[b]									
CAPS-5	−0.305	-.315	−7.843	0.039	276	<.001	[−0.381, − 0.228]	−0.944	.427
PTCI blame	0.291	.032	0.954	0.305	276	.341	[−0.310, 0.892]	0.115	.057
PTCI self-blame predicted by CAPS-5[c]									
PTCI blame	−0.370	-.379	−10.790	0.034	258	<.001	[−0.437, − 0.302]	−1.343	.558
CAPS-5	0.002	.025	0.570	0.004	258	.569	[−0.006, 0.011]	0.071	.035
IES-R Index predicted by PTCI total[c]									
IES-R Index	−0.352	-.376	−9.409	0.037	409	<.001	[−0.425, − 0.278]	−0.930	.422
PTCI	0.051	.088	2.192	0.023	409	.029	[0.005, 0.097]	0.217	.108
PTCI total predicted by IES-R Index *Reverse*[c]									
PTCI	−0.131	-.133	−3.121	0.042	421	.002	[−0.214, − 0.049]	−0.304	.150
IES-R Index	0.128	.080	1.862	0.069	421	.063	[−0.007, 0.264]	0.182	.090
IES-R Other predicted by PTCI total[b]									
IES-R Other	−0.268	-.276	−6.875	0.039	401	<.001	[−0.345, − 0.191]	−0.687	.325
PTCI	0.029	.056	1.346	0.022	401	.179	[−0.013, − 0.072]	0.134	.067
PTCI total predicted by IES-R Other *Reverse*[a]									
PTCI	−0.155	-.157	−3.797	0.041	418	<.001	[−0.236, 0.075]	−0.351	.183
IES-R Other	0.190	.102	2.567	0.074	418	.011	[0.045, 0.336]	0.251	.125

Note: PTCI = Posttraumatic Cognitions Inventory, IES-R Index = Impact of Events Scale – Index trauma, IES-R Other = Impact of Events Scale – All other traumas, CAPS-5 = Clinical Administered PTSD Scale for DSM-5.
[a]Two outliers were identified and excluded from the analysis.
[b]Four outliers by three participants were identified and excluded from the analysis.
[c]One outlier was identified and excluded from the analysis.

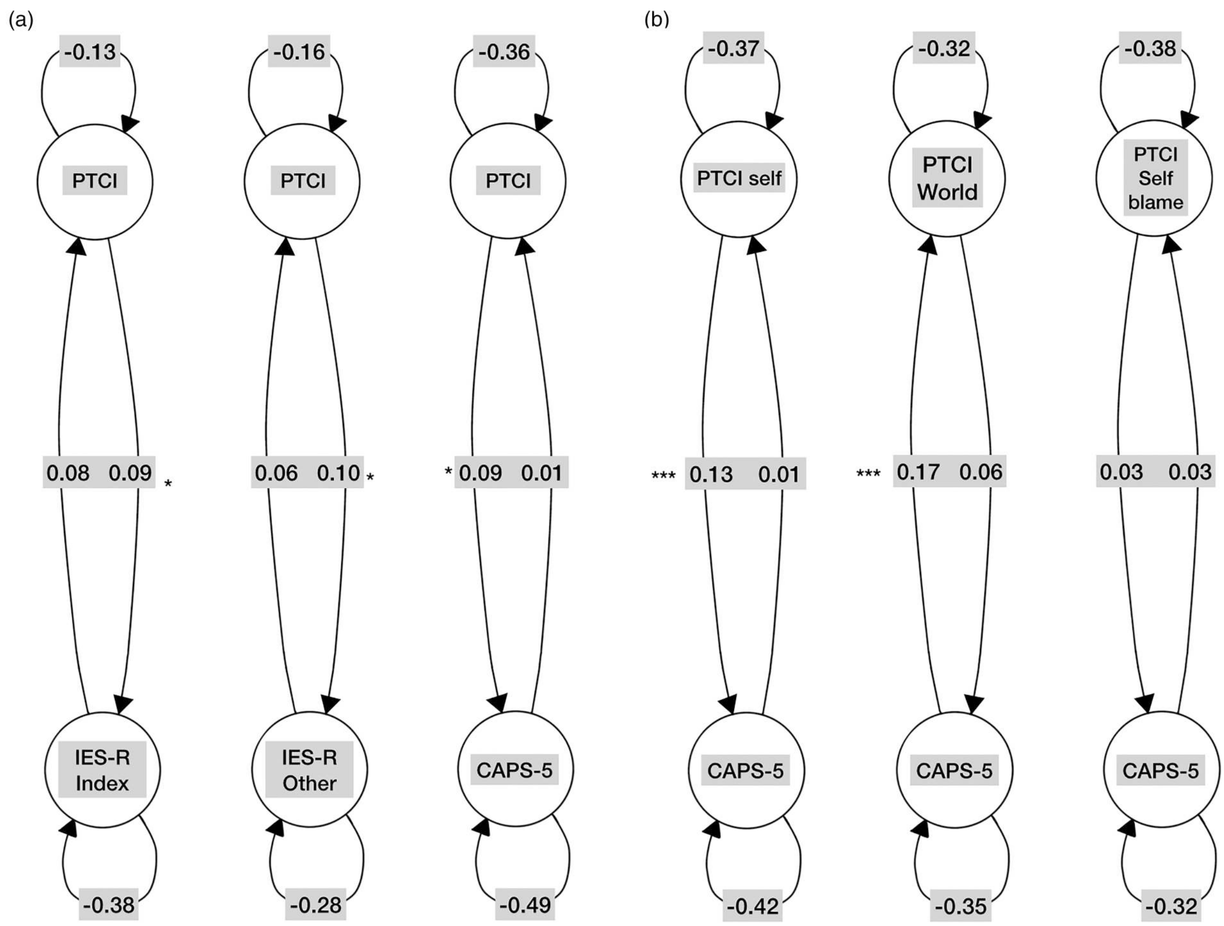

Figure 1. Graphic representation of the granger causality relationships for the PTCI subscales. Note: PTCI = Posttraumatic Cognitions Inventory, IES-R Index = Impact of Events Scale - Index trauma, IES-R Other = Impact of Events Scale - All other traumas, CAPS-5 = Clinical Administered PTSD Scale for DSM-5.

autocorrelations were significant and negative. The number of outliers removed per analysis is reported in Table 1.

3.2.1 PTCI total score with CAPS-5

Changes in the PTCI preceded the CAPS-5 scores ($\beta = .085$, $p < .05$) at the next assessment, whereas the CAPS-5 did not significantly predict subsequent PTCI scores (i.e. reverse test) ($\beta = .005$, $p > .05$). The relationship with the PTCI and subsequent CAPS scores was not moderated by treatment ($b = 0.028$, $t(285) = 1.546$, SE = 0.018, $p = .123$), which also applied to the reverse relationship ($b = -0.010$, $t(288) = -0.065$, SE = 0.153, $p = .948$). We reran the analyses excluding the D4 criterion from the CAPS-5 score, because it includes negative emotions and thus might have some overlap with the PTCI, but this did not change the results.

3.2.2 PTCI on the level of subscales with CAPS

Results of the analyses on the level of PTCI subscales are reported in Table 1 and Figure 1b. PTCI *negative cognitions about oneself* scores positively predicted and preceded changes in subsequent CAPS-5 scores ($\beta = .132$, $p < .05$), while CAPS-5 scores did not predict changes in PTCI *negative cognitions about oneself* scores ($\beta = .001$).

PTCI *negative cognitions about the world* scores did not predict changes in CAPS scores at the next assessment ($\beta = .058$, $p > .05$), while CAPS scores were positively predictive of subsequent PTCI *negative cognitions about the world* changes ($\beta = .170$, $p < .05$).

PTCI *self-blame* scores were not associated with CAPS-5 scores at the next assessment, ($\beta = .032$, $p > .05$), nor were the CAPS-5 scores predictive of subsequent *PTCI self-blame* scores ($\beta = .025$, $p > .05$).

3.2.3 PTCI total score with IES-R Index Trauma. While the PTCI scores predicted subsequent IES-R Index trauma scores (β= -.088, $p < .05$), scores on the IES-R Index trauma scale did not predict the PTCI scores at the next assessment (β= .080, $p > .05$). The effects were not moderated by treatment: PTCI as predictor, $b = 0.052$, $t(408) = 1.515$, SE = 0.035, $p = .131$; IES-R Index trauma scores s predictor, $b = 0.061$, $t(420) = 0.614$, SE = 0.010, $p = .539$.

3.2.4 PTCI total score with IES-R Other traumas. The PTCI scores did not predict IES-R Other trauma scores at the next assessment ($\beta = .056$, $p > .05$), whereas the effect of IES-R Other trauma scores on PTCI scores at the next assessment was significant ($\beta = .102$, $p < .05$). Thus, changes in IES-R Other trauma scores preceded subsequent changes in PTCI scores. Again, there was no moderation by treatment with the PTCI, $b = -0.004$, $t(400) = -0.126$, SE = 0.033, $p = .900$, and the IES-R Other traumas, $b = 0.096$, $t(417) = 0.859$, SE = 0.111, $p = .391$.

4. Discussion

The present study was the first to examine the role of trauma-associated negative cognitions, other than encapsulated beliefs, on PTSD symptoms in the treatment of patients with PTSD from childhood trauma with EMDR and ImRs.

Consistent with our hypothesis we found that changes in trauma-related negative cognitions preceded changes in PTSD symptoms in two out of three outcomes. For the IES-R Index trauma as well as the CAPS changes in trauma-related negative cognitions preceded changes in PTSD symptoms, but the reverse was not found. This unidirectional relationship provides some evidence for causality between trauma-related negative cognitions and PTSD symptoms, supporting the idea that changes (i.e. reduction) in cognitions precede a reduction in PTSD symptoms, resembling findings of several earlier studies (Brown et al., 2019). For the third outcome, IES-R Other Traumas, only the reversed relationship (changes in PTSD symptoms preceding changes in trauma-related negative cognitions) was significant. One reason for this might be that the index trauma was addressed early in treatment (right at the beginning in EMDR and during the first six sessions in ImRs) while other traumas were processed later in treatment. Maybe the reduction in trauma-associated negative cognitions related to other traumas was a result of the generalization effect of treatment experiences and therefore followed the reduction in PTSD symptoms.

Only changes in the PTCI subscale negative cognitions related to oneself preceded PTSD symptom reduction. These findings support our second hypothesis that the reduction in trauma-related negative cognitions concerning oneself is particularly important for the improvement of PTSD symptoms in our group of patients (childhood trauma-associated PTSD). This is in line with earlier findings (Foa & Rauch, 2004; Karl et al., 2009; Kumpula et al., 2017; Long et al., 2011) pointing out the significance of these type of cognitions. Our findings are also consistent with earlier findings indicating that negative cognitions related to oneself and self-blame might be especially relevant in survivors of (sexual) violence (Beck et al., 2016; Littleton et al., 2012; Pence et al., 2014). In our sample, the index trauma concerned sexual, physical, or mixed abuse or domestic violence for 92.9% of all participants (Boterhoven de Haan et al., 2020). The findings are also in agreement with a meta-analysis reporting that psychological interventions for PTSD improve negative self-concept with moderate to large controlled effect sizes (Banz et al., 2022).

The predictive relationship between trauma-related negative cognitions and PTSD symptoms was not moderated by treatment condition, indicating that the role of cognition might be similar in EMDR and ImRs. This is in contrast with an earlier analysis on this trial showing that changes in the idiosyncratic encapsulated belief related to the index trauma preceded symptom reduction only in the ImRs condition (Rameckers et al., 2024). The difference might be explained by the fact that our analysis refers to general negative cognitions, whereas the study by Rameckers et al. dealt with an individual belief relating to a specific situation of the index trauma. On the other hand, the absence of a moderating effect of treatment is in line with earlier studies which found a mediating effect of trauma-related negative cognitions on treatment outcomes in different therapeutic approaches (Brown et al., 2019). Despite the differences in the treatment models (Cooper et al., 2017), this may indicate a general mechanism of change in PTSD treatment, meaning that different interventions might have shared pathways of change. Our findings are in line with those of earlier studies in which changes in trauma-related negative cognitions preceded changes in PTSD symptoms in different trauma focussed treatments such as PE (e.g. Kumpula et al., 2017; McLean, Yeh, et al., 2015; Zalta et al., 2014), CPT (Schumm et al., 2015), and trauma focussed CBT (Kleim et al., 2013; Zoellner et al., 2011). This in turn is consistent with various established explanatory models of PTSD, in which trauma-associated cognitions play a central role (Ehlers & Clark, 2000; Foa & Kozak, 1986; Resick et al., 2016; Shapiro & Forrest, 2001). However, it should be noted that there are also a few studies, particularly for PE (Hagenaars et al., 2010; McLean, Su, et al., 2015) and CPT (Dillon et al., 2019; Held et al., 2022; Lee et al., 2021), which have not found this temporal connection.

The potential role of cognitions in PTSD treatment might be interesting in our understanding of non-responding. If a reduction in trauma-related negative cognitions is required for a reduction in PTSD symptoms, a lack of change in cognitions might – partly – explain non-respondence; subsequently having the therapist to focus more on cognitive interventions. This might be an argument for an assessment of cognition on a session level also in EMDR and ImRs treatments like it was proposed for PE (Kooistra et al., 2023).

However, it should be noted that changes in trauma-related negative cognitions might not be the exclusive change mechanism in PTSD treatment, as there is evidence that belief change plays a similar role in CBT in general (e.g. Garratt et al., 2007; Lorenzo-Luaces et al., 2015).

4.1 Limitations and strengths

The main limitation of our analysis is that we had limited process data. The CAPS and PTCI were assessed at baseline, post-treatment, and at 8-weeks and 1-year follow up, while IES-R was assessed every session and the IES-R and PTCI were additionally assessed between sessions 6 and 7. To get more reliable evidence on change processes it would be valuable to have more assessment points within the treatment period. Moreover, since our study included patients with PTSD from childhood trauma, our results are limited to this group of patients. All other limitations of the IREM study also apply to this analysis (Boterhoven de Haan et al., 2020) including the fact that there were two active treatment arms and no control condition.

This study was the first to analyse the relationship between general trauma-related negative cognitions and changes in the PTSD symptomatology in patients treated with EMDR and ImRs. Furthermore, for the first time, this relationship was investigated in adult patients with PTSD from childhood trauma. Thus, the study corroborated a general change mechanism in different PTSD treatment methods and with different types of trauma. The treatment from trained therapists who were assessed by adherence checks combined with the data assessment incorporating self-ratings and interviews by trained blind raters support the high quality of the IREM-RCT. Given that only one study has so far compared EMDR and ImRs, further studies are needed to replicate the results and generate more insights into the working mechanisms.

4.2 Conclusion

To conclude, our study showed that the role of trauma-related negative cognitions in the treatment with EMDR and ImRs seems to be similar to other PTSD treatments like cognitive processing therapy (CPT), CT and PE. Changes in trauma-related negative cognitions preceded the changes of PTSD symptoms in both EMDR and ImRs treatment. To further verify our findings and to increase generalizability analyses should be replicated with a higher frequency of assessments (e.g. weekly during the treatment period) and also in a sample with adulthood trauma.

Acknowledgements

We thank all patients, therapists and research assistants involved in this study.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Declaration of interests

C.W.L. reports grants from the EMDR Research Foundation, during the conduct of the study; and personal fees from Psychology Training, outside the submitted work. A.A. publishes about ImRs in scientific articles and book chapters, and occasionally gives workshops on this treatment. The financial remuneration he receives goes to the University of Amsterdam to support research. E.F. reports personal fees from workshops and lectures on ImRs and PTSD treatment, and grants from the University of Lübeck (Habiliationsförderung für Wissenschaftlerinnen, Sektion Medizin), outside the submitted work. The remaining authors declare that they have no competing interests.

Funding

This work was supported by the Anxiety Disorders Foundation of Western Australia (grant number PG51012100); the EMDR Research Foundation (ref: PG10400309) and the Commonwealth Government, through an 'Australian Government Research Training Program Fees Offset'. We acknowledge financial support by Land Schleswig-Holstein within the funding program 'Open Access Publikationsfond'.

Author contributions

Conceptualization, A.A., C.W.L., M.R., and E.F.; Methodology, A.A. and C.W.L.; Software, A.A. and S.R.; Formal analysis, A.A. and S.R.; Investigation, N.A., E.F., A.S., C.W.L., K.B.d.H., M.R., and A.A.; Resources, E.F., C.W.L., M.R., and A.A.; Data curation, S.R. and K.B.d.H.; Writing – original draft preparation, N.A.; Writing – review and editing, N.A., E.F., A.S., C.W.L., K.B.d.H., M.R., and A.A.; Revision following feedback and submission: N.A.; Visualization, S.R.; Supervision, C.W.L., M.R., and A.A.; Project administration, C.W.L., K.B.d.H., and A.A.; Funding acquisition, C.W.L. and K.B.d.H. All authors have read and agreed to the published version of the manuscript.

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