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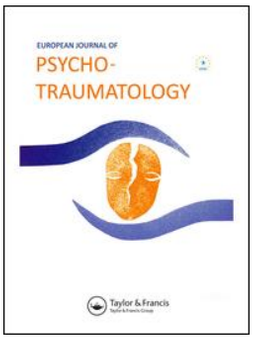

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CLINICAL RESEARCH ARTICLE

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Imagery Rescripting (ImRs) and Eye Movement Desensitization and Reprocessing (EMDR) as treatment of childhood-trauma related post-traumatic stress disorder (Ch-PTSD) in adults: effects on Schema Modes

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ABSTRACT

Background: Many patients with post-traumatic stress disorder (PTSD) due to childhood trauma (Ch-PTSD) also suffer from comorbid personality pathology. Little is known about the effectiveness of treatments for Ch-PTSD in reducing the comorbid personality pathology. Schema Modes are an operationalization of personality pathology according to schema therapy and can be measured with the Schema Mode Inventory (SMI). Therefore, we evaluated the effects of two treatments for adult patients with Ch-PTSD on Schema Modes.

Method: Participants ($n = 114$) of the Imagery Rescripting and Eye Movement Desensitization and Reprocessing (IREM) Randomized Clinical Trial (Boterhoven de Haan, K. L., Lee, C. W., Fassbinder, E., Voncken, M. J., Meewisse, M., Van Es, S. M., Menninga, S., Kousemaker, M., & Arntz, A. (2017). Imagery rescripting and eye movement desensitization and reprocessing for treatment of adults with childhood trauma-related post-traumatic stress disorder: IREM study design. *BMC Psychiatry*, *17*(1), 1–12, Boterhoven de Haan, K. L., Lee, C. W., Fassbinder, E., van Es, S. M., Menninga, S., Meewisse, M.-L., Rijkeboer, M., Kousemaker, M., & Arntz, A. (2020). Imagery rescripting and eye movement desensitization and reprocessing as treatment for adults with post-traumatic stress disorder from childhood trauma: Randomised clinical trial. *The British Journal of Psychiatry*, *217*(5), 609–615) with Ch-PTSD who filled in the SMI next to other outcomes, were randomly allocated to a 12-session treatment of Imagery Rescripting (ImRs) or Eye Movement Desensitization and Reprocessing (EMDR). The SMI was collected at waitlist, pre-treatment, mid-treatment, posttreatment, and 8-week and 1-year follow-up.

Results: For both treatments, patients reported large reductions in the Maladaptive Schema Modes and improvements in the Adaptive Schema Modes (Cohen's $d = .94–1.18$) from pre-treatment to posttreatment, 8-week follow-up, and 1-year follow-up. No statistically significant differences were found between ImRs and EMDR regarding changes in Schema Modes over time. No significant changes were observed during the waitlist period.

Conclusions: ImRs and EMDR showed improvements in Schema Modes when primarily targeting Ch-PTSD. The results indicate the possible value of both treatments in reducing comorbid personality pathology.

Reescritura de imágenes (ImRs) y desensibilización y reprocesamiento por movimientos oculares (EMDR) como tratamiento del trastorno de estrés postraumático relacionado con traumas infantiles (TEPT-Ch) en adultos: efectos sobre los modos de esquema

Antecedentes: Muchos pacientes con trastorno de estrés postraumático (TEPT) debido a traumas infantiles (TEPT-Ch) también sufren patología de personalidad comórbida. Se sabe poco sobre la eficacia de los tratamientos para el TEPT-Ch para reducir la patología de personalidad comórbida. Los modos de esquema son una operacionalización de la patología de personalidad según la terapia de esquemas y se pueden medir con el Inventario de modos de esquema (SMI). Por lo tanto, evaluamos los efectos de dos tratamientos para pacientes adultos con TEPT-Ch sobre los modos de esquema.

Método: Los participantes ($n = 114$) del ensayo clínico aleatorizado de reescritura de imágenes, y desensibilización y reprocesamiento por movimientos oculares (IREM) (Boterhoven de Haan et al., 2017, 2020) con TEPT crónico que completaron la SMI junto con otros resultados, fueron asignados aleatoriamente a un tratamiento de 12 sesiones de reescritura de imágenes (ImRs) o desensibilización y reprocesamiento por movimientos oculares (EMDR). La SMI se recopiló en la

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Schema Modes; personality pathology; post-traumatic stress disorder; childhood trauma; effect; effectiveness; randomized controlled trial

PALABRAS CLAVE

Modos de esquema; patología de personalidad; trastorno de estrés postraumático; trauma infantil; efecto; efectividad; ensayo controlado aleatorio

HIGHLIGHTS

- This is the first study comparing the effects of ImRs and EMDR for PTSD due to childhood trauma (Ch-PTSD) on Schema Modes.
- Both ImRs and EMDR showed improvements in Schema Modes when primarily targeting Ch-PTSD, while waitlist did not lead to significant changes. No significant differences were found between ImRs and EMDR on the Maladaptive and Adaptive Schema Modes.
- The results suggest that EMDR and ImRs have a potential value for the reduction of comorbid personality pathology.
- One recommendation for clinical practice is to evaluate comorbid personality pathology after patients with Ch-PTSD and comorbid personality problems have completed PTSD treatment, to determine if additional PD-specific treatment is still needed.

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lista de espera, antes del tratamiento, a mitad del tratamiento, después del tratamiento y en el seguimiento a las 8 semanas y al año.
Resultados: Para ambos tratamientos, los pacientes reportaron grandes reducciones en los modos de esquema desadaptativo y mejoras en los modos de esquema adaptativo (*d* de Cohen = .94 a 1.18) desde el pretratamiento hasta el postratamiento, el seguimiento a las 8 semanas y el seguimiento a 1 año. No se encontraron diferencias estadísticamente significativas entre ImRs y EMDR en cuanto a los cambios en los modos de esquema a lo largo del tiempo. No se observaron cambios significativos durante el período de lista de espera.
Conclusiones: ImRs y EMDR mostraron mejoras en los modos de esquema cuando se enfocaron principalmente en el TEPT-Ch. Los resultados indican el posible valor de ambos tratamientos en la reducción de la patología de personalidad comórbida.

1. Introduction

Childhood trauma (i.e. sexual, physical, and emotional abuse, and neglect) is not only related to the development of Post-traumatic Stress Disorder (PTSD) (Carr et al., 2013; Ullman & Brecklin, 2002) but also to the development of personality pathology (Carr et al., 2013; Lobbestael, Arntz, et al., 2010; Martins et al., 2011). For instance, parental neglect is a predictor for current PTSD (Meewisse et al., 2011) and borderline personality disorder (BPD) (Stepp et al., 2016). Also, childhood sexual abuse is related to the development of both PTSD and BPD (Bohus et al., 2013; Scheiderer et al., 2015). Childhood emotional abuse plays an important role in the severity of PTSD (Rameckers et al., 2021), and predicts cluster-C personality disorders (PD) and BPD (Lobbestael, Arntz, et al., 2010).

Indeed, many patients diagnosed with childhood trauma-related PTSD (Ch-PTSD) also suffer from comorbid personality pathology (Friborg et al., 2013; MacIntosh et al., 2015). Both PTSD and PD substantially decrease the level of healthy functioning of patients in all life domains (MacIntosh et al., 2015). It is therefore important to know whether the treatments for Ch-PTSD not only address PTSD symptoms but also reduce comorbid personality pathology.

Although meta-analyses demonstrate the effectiveness of trauma-focused treatments (TFT) on the reduction of Ch-PTSD (Dorrepaal et al., 2014; Ehring et al., 2014), little is known about the effects of these treatments on comorbid personality pathology. To date, only six studies have been conducted, and some of these studies also included PTSD due to trauma in adulthood. In a recent randomized controlled trial, Van den End et al. (2024) compared the effectiveness of TFT to a combined TFT-PD treatment for patients with PTSD and comorbid cluster-C PD. Both treatments were effective in the reduction of PTSD as well as PD pathology, with no difference between the conditions. The study by Markowitz et al. (2015) found that 43% of the patients with a PD diagnosis at baseline no longer met the criteria following 14 weeks of psychotherapy for chronic PTSD. Patients with significant PTSD symptom improvement were even more likely (56%) to lose their PD diagnosis. The study by Bovin et al. (2017) investigated the long-term relationship between the severity of PTSD and characteristics of PD in female survivors of rape who received TFT. The results showed that reductions in PTSD symptoms were associated with decreased severity of comorbid PDs, including BPD and antisocial PD. Kleindienst et al. (2021) compared dialectical behaviour therapy for PTSD (DBT-PTSD) with TFT (cognitive processing therapy (CPT)) for patients with a dual diagnosis of Ch-PTSD and BPD. The DBT-PTSD protocol was aimed at treating both PTSD and BPD symptoms. Both treatments significantly reduced PTSD and BPD symptoms, with DBT-PTSD favouring CPT on both outcomes. Lastly, in two open cohort studies, De Jongh et al. (2020) and Kolthof et al. (2022) investigated the impact of brief intensive TFT for PTSD on comorbid BPD symptoms. Both found significant decreases in BPD symptoms along with a reduction in PTSD symptoms. Thus, although evidence is scarce, these studies indicate that TFT for PTSD results in a reduction of comorbid personality pathology.

In clinical practice, Imagery Rescripting (ImRs) and Eye Movement Desensitization and Reprocessing (EMDR) have been offered to treat Ch-PTSD as well as personality pathology. Both treatments focus on changing the maladaptive information (including thoughts, sensations, and emotions) related to the traumatic events underlying PTSD or personality pathology, although they differ in their hypothesized mechanisms of action. EMDR uses distraction, such as eye movements, to tax the working memory while recalling traumatic memories. The working memory hypothesis states that by overloading the working memory, the vividness and emotional intensity of the memory are reduced (Gunter & Bodner, 2008; Shapiro, 2018). In contrast, ImRs is aimed to alter the meaning and emotional response of the memory by replacing the traumatic narrative with a more positive or empowering version. While EMDR emphasizes desensitization through memory weakening, ImRs focuses on the fulfilment of the child's unmet needs and on changing the dysfunctional meaning associated with the memory (Arntz & Jacob, 2017).

Both ImRs and EMDR are effective in the treatment of PTSD (Arntz et al., 2013; Bisson et al., 2013; Lewis

et al., 2020; Raabe et al., 2015). According to a recent trial, the IREM study, these interventions did not differ in effectiveness for the treatment of Ch-PTSD (Boterhoven de Haan et al., 2020). Moreover, some studies provide (indirect) support that ImRs and EMDR result in a reduction of personality pathology. Hafkemeijer et al. (2020) found that EMDR yields significant improvements in personality functioning. Also, Weertman and Arntz (2007) showed ImRs to be effective for patients with PD. In addition, ImRs is an important experiential technique extensively used in schema therapy, an effective treatment for personality pathology (Arntz et al., 2022; Assmann et al., 2024; Bamelis et al., 2014; Farrell et al., 2009; Nadort et al., 2009; Schaap et al., 2016; Sempértegui et al., 2013). Taken together, EMDR and ImRs are effective for Ch-PTSD, and there is growing evidence for their effectiveness on personality pathology.

Closely linked to personality pathology are Schema Modes. Schema Modes are one of the three key concepts in schema therapy, next to schemas and schema coping (Arntz & Jacob, 2017). Schemas are trait-like patterns of dysfunctional beliefs, emotions, and behavioural responses. Schemas can be triggered within a person, evoking distress and emotion. How schema activation is being handled (i.e. dysfunctional are surrendering to the schema, avoiding the schema, or acting and believing contrary to what the schema represents) is referred to as schema coping. Schema Modes are the emotional, cognitive, and behavioural states of a person when schemas and the coping response are activated. In schema therapy, the (personality) pathology of a patient is conceptualized in an idiosyncratic Schema Mode model (Arntz & Jacob, 2017). Over 20 Schema Modes have been proposed so far, divided into four categories: the maladaptive Child Modes, Coping Modes and Parent Modes, and the Healthy, adaptive Modes (Lobbestael et al., 2008; Young et al., 2003). Patients with personality pathology are theorized to show a higher intensity and frequency of maladaptive Schema Modes and lower levels of the adaptive Schema Modes compared to non-patients (Lobbestael et al., 2008), which is also supported by research findings (Bach & Farrell, 2018; Bamelis et al., 2011). Moreover, several studies confirmed associations between PD scores and their PD-specific Mode models (Arntz et al., 2005; Bamelis et al., 2011; Jacobs et al., 2019; Lobbestael et al., 2005, 2008). In addition, the Mode model aligns with recently proposed alternative models of PDs (Bach & Bernstein, 2019). For example, Bach et al. (2016) concluded that correlations between DSM-5 traits and schema modes were strong and conceptually coherent. Lastly, in the treatment of PDs, changes in Schema Modes have been found to precede changes in personality pathology and general functioning and not vice versa, indicating they underlie personality pathology and play a role as mechanisms of change (Yakın et al., 2020). In short, Schema Modes are one of the key concepts in schema therapy to conceptualize personality pathology, and several studies have underlined the relatedness of Schema Modes with personality pathology. Therefore, we will use Schema Modes as a proxy for personality pathology.

In sum, Ch-PTSD and personality pathology often co-occur and have similar developmental roots. Although research has provided evidence for the effectiveness of TFT on Ch-PTSD, little is known about the course of personality pathology during Ch-PTSD treatment and whether specific TFT treatments differ in their effect on personality pathology. Therefore, we investigated if treatment of Ch-PTSD by ImRs and EMDR is associated with improvements in Schema Modes, and if there is a difference between both treatments. No a priori assumptions about the direction of the difference were made. We also explored if there were any differences in the changes between Schema Mode clusters. Lastly, we explored to what degree changes in Schema Modes could be explained (in a statistical sense) by changes in PTSD severity, to check if changes in Schema Modes are (partially) independent from changes in PTSD severity. Investigating the effect of ImRs and EMDR for Ch-PTSD on changing Schema Modes can offer insight into the effects of PTSD treatment on comorbid personality pathology. With this knowledge, we can improve treatment indications for patients suffering both from Ch-PTSD and dysfunctional Schema Modes.

2. Method

2.1. Study design and participants

This study is part of the IREM study, an international multicentre Randomized Clinical Trial (Boterhoven de Haan et al., 2017). The IREM study was registered on the Australian and New Zealand Clinical Trials Registry under the identifier ACTRN12614000750684. Approval for the study was obtained by ethical committees in all participating countries. For this secondary analysis, approval of an amendment was obtained by the Ethical Committee Psychology (ECP) of the University of Maastricht. Only one site did not participate in this substudy, since recruitment was already underway. In total 114 of the 155 patients of the IREM study were included in this secondary analysis.

Patients between 18 and 70 years old with a primary diagnosis of PTSD due to trauma(s) before the age of 16 were recruited at the participating mental health care centres. Excluded were patients with acute PTSD, alcohol or drug dependence, benzodiazepine use, comorbid psychotic or DSM-IV Bipolar disorder type 1, acute suicide risk, or an IQ below 80. Patients

who had received PTSD-focused treatment during the past three months or more than two sessions of either EMDR or ImRs prior to the study were also excluded. Patients were not allowed to start with any form of evidence-based treatment for PTSD or medication during screening or the study's treatment period.

2.2. Measures and interventions

2.2.1. Measures

To measure Schema Modes the *Schema Mode Inventory (SMI-143)* (Bamelis et al., 2011) was used. The SMI-143 is an extended version of the Schema Mode Inventory (118 items), a self-report questionnaire that measures 16 Modes. The Dutch and German versions of SMI-118 were both validated, and acceptable to good psychometric properties were found (Lobbestael, van Vreeswijk, et al., 2010; Reiss et al., 2012). In the 143-item SMI, two Modes were added, validated by Bamelis (Bamelis et al., 2011). The number of items per subscale/Schema Mode ranges from 4 to 10. The mean subscale score is used and runs from 1 (minimum, *never*) to 6 (maximum, *always*). The Schema Modes are clustered into one Adaptive Modes group (i.e. Healthy Adult Mode, Happy Child mode) and six maladaptive Modes Clusters: (1) Vulnerable Child Mode, (2) Externalizing Child Modes (i.e. Angry Child, Enraged Child, Impulsive Child, and Undisciplined Child), (3) Dysfunctional Parent Modes (i.e. Demanding and Punitive Parent), 4) Avoidant Coping Modes (i.e. Compliant Surrender, Detached Protector, Detached Self-Soother), 5) Overcompensating Modes (i.e. Self-Aggrandizer and Bully and Attack), 6) Overcontrolling Modes (i.e. Perfectionistic Overcontroller, Suspicious Overcontroller).

Clinician-administered PTSD Scale for DSM-5 (CAPS-5).

This is a structured interview that assesses DSM-5-defined PTSD symptoms (Weathers et al., 2013). It consists of 30 items that assess PTSD symptoms over the previous month. The CAPS yields a dimensional total severity score, a dimensional score per symptom cluster, and diagnostic status. It measures both the frequency and intensity of the 17 DSM-IV PTSD symptoms (range 0–136). The CAPS-5 has demonstrated high internal consistency, strong interrater and test-retest reliability, and good validity (Boeschoten et al., 2018; Weathers et al., 2018).

2.2.2. Interventions and therapists

Both conditions, ImRs and EMDR, were offered to a maximum of 12 90-minute sessions, offered twice a week. The ImRs treatment was based on the protocol described by Arntz and Weertman (1999). In ImRs, the patient is asked to recall the trauma memory and is guided to imagine a different ending that fulfils the unmet childhood needs of the patient. In the first six sessions, the therapist intervenes, in the final six sessions the adult self of the patient intervenes and in the next phase, the patient re-experiences the new script from the child's perspective.

EMDR treatment is based on the eight-phase protocol outlined by Shapiro (2001). The first session involves preparation up to target assessment and affect tolerance training including a safe place exercise. From the second session on, desensitization starts. The patient is being asked to focus on the trauma memory while following an eye-tracking task. After the distress decreases to 0 or 1, the preferred positive cognition is installed, followed by a body scan.

To prevent contamination of the treatment conditions, a restriction was placed on types of unblocking strategies, particularly those using imagery during the interweave. For the specific characteristics of the treatment conditions and treatment adherence. we refer to the study protocol described by Boterhoven de Haan et al. (2017).

2.3. Procedure

Patients were screened in the participating centres. During this screening, the motivation of the patient was checked, an informed consent was signed by the patient, and additional information was given. Randomization took place after this procedure was completed and was based on block randomization ($n = 2$, 4, 6 per block) per site, to guarantee a balance between conditions per site and over time. Patients completed the SMI on the computer. Assessments were conducted before the wait (only if patients had a wait of longer than three weeks prior to the start of treatment), pre-treatment, mid-treatment, posttreatment, and 8-week and 1-year follow-up. Assessments were conducted by research assistants who were blind to treatment conditions. Recruitment took place from March 2015 to June 2019.

2.4. Data analytic approach

To enhance the alignment of our findings to the primary IREM study, similar analyses were conducted. The data was analysed using a mixed regression model, with a random factor for time on the level of site, fitted with an unstructured covariance structure for the repeated measures within participants if convergence allowed. If the model did not converge, we added a random intercept for site instead. We tested the fit of different covariance structures (i.e. AR(1), heterogeneous AR(1), ARMA(1,1), and compound symmetry) for the repeated part of the model if necessary. It was decided to add a level for site as this allowed us to control for any specific effects caused by the treatment site (e.g. certain characteristics of patient population, therapists, referral procedures, etc.).

The main analyses were run on the Maladaptive Modes and Adaptive Modes as outcome variables separately. The same analyses were also exploratively run on each of the six Maladaptive Mode clusters (i.e. Avoidant Coping Modes, Overcompensating Coping Modes, Dysfunctional Parent Modes, Vulnerable Child Mode, Overcontrolling Modes, and Externalizing Child Modes).

All model comparisons were made based on the -2 loglikelihood Chi-square tests, and other indices, such as the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The assumptions were tested based on the model residuals and predicted values. We also inspected the influence of outliers, defined by Pearson residuals > the absolute value of 3 (Blatná, 2006), by running the analyses after removing outliers and by inspecting if this influenced the results. The significance cut-off was an alpha level of .05. As we conducted multiple explorative analyses (i.e. 24 interactions), we took the chance of increased Type I errors into account. Based on a binomial test on the number of significant findings it was examined what the chance was of incidental findings.

Sensitivity analyses were conducted by adding the CAPS-5 score at each assessment as a dimensional covariate to examine if changes in the CAPS-5 explained changes in Schema Modes. However, as the CAPS-5 was not administered at the mid-treatment assessment, we used linear interpolation to estimate the CAPS-5 scores at this assessment. We only allowed the mid-treatment assessment to be estimated if the data from the pre-treatment assessment and the posttreatment assessment were available.

3. Results

3.1. Participants

In total, 114 participants ($n = 57$ in each treatment condition) from two countries were included in the analyses: The Netherlands ($n = 92$, 5 sites) and Germany ($n = 22$, 1 site). Table 1 shows the demographic variables of the participants.

3.2. Maladaptive and adaptive modes

With regard to the main analyses, all assumptions were met. Table 2 shows the mean scores of all Schema Mode categories per assessment and treatment. Table 3 shows the results of the main analyses. Figure 1 shows the change in the Maladaptive and Adaptive Modes per treatment over the course of assessments. Unless otherwise specified, no outliers were detected.

3.2.1. Maladaptive modes

The mean scores on the Maladaptive Modes at pre-treatment are 3.20 (EMDR) and 3.28 (ImRs), comparable to the clinical population (3.00) and higher than the non-clinical population (2.04) (see Table 2, Bamelis et al., 2011). Compared to the pre-treatment assessment, on the scores on the Maladaptive Modes of the SMI a statistically significant decrease (compared to

Table 1. Demographic characteristics of the Total Sample, and Both Treatment Groups.

Characteristic	Total sample ($n = 114$)	EMDR ($n = 57$)	ImRs ($n = 57$)
Age, mean (SD)	38.81 (10.75)	38.84 (10.85)	38.77 (10.74)
Gender			
Female	87 (76.3%)	45 (78.9%)	42 (73.7%)
Male	27 (23.7%)	12 (21.1%)	15 (26.3%)
Index traumas			
Sexual abuse / assault	51 (44.7%)	25 (43.9%)	26 (45.6%)
Physical abuse	31 (27.2%)	18 (31.6%)	13 (22.8%)
Mixed abuse	8 (7%)	2 (3.5%)	6 (10.5%)
Domestic violence	13 (11.4%)	6 (10.5%)	7 (12.3%)
Serious injury/ death	6 (5.3%)	5 (8.8%)	1 (1.8%)
Other	5 (4.5%)	1 (1.8%)	4 (7.1%)
Comorbid disorders			
Mood disorder	75 (65.8%)	36 (63.2%)	39 (68.4%)
Anxiety disorder	52 (45.6%)	30 (52.6%)	22 (38.6%)
Eating disorder	17 (14.9%)	10 (17.5%)	7 (12.3%)
Substance use disorder	17 (14.9%)	10 (17.5%)	7 (12.3%)
Ethnic background			
Dutch	60 (52.6%)	29 (50.9%)	31 (54.4%)
German	21 (18.4%)	13 (22.8%)	8 (14%)
Other European	8 (7%)	5 (8.8%)	3 (5.3%)
Moroccan	10 (8.8%)	3 (5.3%)	7 (12.3%)
Surinamese/Antillean	8 (7%)	4 (7%)	4 (7%)
Asian	4 (3.5%)	2 (3.5%)	2 (3.5%)
African	1 (0.9%)	1 (1.8%)	0
Other	2 (1.8%)	0	2 (3.5%)
Education level			
No/primary education	7 (6.1%)	2 (3.5%)	5 (8.8%)
Secondary education	31 (27.2%)	20 (35.1%)	11 (19.3%)
Tertiary education	71 (62.3%)	34 (59.6%)	37 (64.9%)
University bachelor/ master	5 (4.4%)	1 (1.8%)	4 (7.1%)

Table 2. Description of the Scores on the Outcomes of each Assessment per Treatment Condition.

Variable	EMDR ($n = 57$)			ImRs ($n = 57$)		
	N	*M*	*SD*	*N*	*M*	*SD*
Adaptive Modes						
Waitlist	24	3.221	0.689	22	3.152	0.532
Pre-treatment	53	3.323	0.710	51	3.151	0.508
Mid-treatment	54	3.684	0.854	51	3.392	0.702
Posttreatment	52	3.974	0.929	51	3.603	0.825
Follow-up 1	52	3.960	1.000	48	3.723	0.817
Follow-up 2	42	3.930	0.938	43	3.763	0.918
Maladaptive Modes						
Waitlist	24	3.192	0.432	23	3.394	0.596
Pre-treatment	53	3.201	0.507	52	3.280	0.575
Mid-treatment	54	2.866	0.626	51	3.067	0.572
Posttreatment	52	2.609	0.653	51	2.776	0.646
Follow-up 1	52	2.558	0.698	48	2.821	0.782
Follow-up 2	42	2.583	0.737	43	2.660	0.764
Avoidant Coping						
Waitlist	24	3.478	0.533	23	3.593	0.771
Pre-treatment	53	3.419	0.582	52	3.443	0.743
Mid-treatment	54	3.028	0.705	51	3.288	0.742
Posttreatment	52	2.661	0.737	51	2.931	0.826
Follow-up 1	52	2.563	0.751	48	2.968	0.874
Follow-up 2	42	2.603	0.863	43	2.816	0.976
Overcompensating Modes						
Waitlist	24	2.153	0.485	23	2.407	0.724
Pre-treatment	53	2.343	0.738	52	2.357	0.651
Mid-treatment	54	2.154	0.650	51	2.259	0.638
Posttreatment	52	2.033	0.589	51	2.089	0.649
Follow-up 1	52	2.044	0.631	48	2.195	0.763
Follow-up 2	42	2.017	0.630	43	2.042	0.644
Dysfunctional Parent Modes						
Waitlist	24	3.304	0.654	23	3.683	0.881
Pre-treatment	53	3.373	0.665	52	3.492	0.903
Mid-treatment	54	3.029	0.785	51	3.283	0.843
Posttreatment	52	2.747	0.729	51	2.930	0.937
Follow-up 1	52	2.681	0.715	48	2.966	0.977
Follow-up 2	42	2.751	0.825	43	2.879	1.031
Vulnerable Child Mode						
Waitlist	24	3.596	0.836	23	4.013	1.004
Pre-treatment	53	3.400	0.996	52	3.752	0.937
Mid-treatment	54	2.832	1.123	51	3.298	1.030
Posttreatment	52	2.587	1.173	51	2.931	1.125
Follow-up 1	52	2.525	1.169	48	2.888	1.215
Follow-up 2	42	2.543	1.146	43	2.723	1.191
Overcontrolling Modes						
Waitlist	24	3.973	0.627	23	3.877	0.826
Pre-treatment	53	3.946	0.666	52	3.909	0.772
Mid-treatment	54	3.693	0.752	51	3.714	0.784
Posttreatment	52	3.391	0.834	51	3.430	0.821
Follow-up 1	52	3.270	0.953	48	3.509	1.012
Follow-up 2	41	3.343	1.001	43	3.255	0.979
Externalizing Child Modes						
Waitlist	24	2.648	0.509	23	2.790	0.613
Pre-treatment	53	2.729	0.586	52	2.726	0.591
Mid-treatment	54	2.457	0.665	51	2.562	0.524
Posttreatment	52	2.233	0.591	51	2.345	0.526
Follow-up 1	52	2.266	0.654	48	2.401	0.703
Follow-up 2	42	2.226	0.702	43	2.246	0.576

Note. EMDR = Eye Movement Desensitization and Reprocessing, ImRs = Imagery Rescripting.

pre-treatment) was found from mid-treatment onwards to the second follow-up assessment, whereas no significant change took place during the wait. There was no significant time x treatment interaction, so there were no differences in the change in Maladaptive Schema Modes between EMDR and ImRs. When we added scores on the CAPS-5 as a covariate, there was only a statistically significant decrease in Maladaptive Modes at mid-treatment and posttreatment assessments compared to pre-treatment. Thus, at follow-up assessments, the change in Maladaptive Modes was explained by changes in the CAPS-5 scores.

3.2.2. Adaptive modes

The mean scores on the Adaptive Modes at pre-treatment are 3.32 (EMDR) and 3.15 (ImRs), comparable to the clinical population (3.00) and lower than the non-clinical population (4.49) (see Table 2, Bamelis et al., 2011). The scores on the Adaptive Modes increased significantly from the mid-treatment assessment onwards to the second follow-up assessment, whereas no significant change took place during wait. Again, no significant time × treatment interactions were observed. Again, after controlling for the CAPS-5, there were no statistically significant increases in Adaptive Modes at both follow-up assessments

Table 3. Mixed Regression Results for the Time and Time*Treatment Effects of the Changes in Schema Mode Clusters.

Assessment	Time					Time * Treatment			
	d	*t*	df	SE	*p*	*d*	*t*	df	SE
Maladaptive Modes[a]									
Waitlist	0.117	1.340	136	0.047	.182	0.178	1.018	136	0.095
Mid-treatment	−0.529	−7.508	247	0.038	**<.001**	0.252	1.779	247	0.076
Posttreatment	−1.031	−11.054	330	0.050	**<.001**	0.226	1.212	330	0.101
Follow-up 1	−1.042	−9.079	324	0.062	**<.001**	0.368	1.607	324	0.124
Follow-up 2	−1.175	−8.676	228	0.073	**<.001**	−0.080	−0.292	228	0.146
Adaptive Modes[b]									
Waitlist	−0.002	−0.017	16	0.061	.986	−0.060	−0.336	53	0.111
Mid-treatment	0.517	5.104	24	0.063	**<.001**	−0.177	−0.948	102	0.116
Posttreatment	0.937	7.681	42	0.076	**<.001**	−0.340	−1.470	106	0.143
Follow-up 1	0.960	7.605	48	0.078	**<.001**	−0.232	−0.965	103	0.139
Follow-up 2	0.970	6.648	56	0.091	**<.001**	0.082	0.289	92	0.174

Note. *d* = Cohen's *d*. Significant effects are indicated in bold. Degrees of freedom are rounded numbers. [a] Fitted with a random intercept and a heterogeneous AR(1) covariance structure. [b] Fitted with a random effect for time and an unstructured covariance structure.

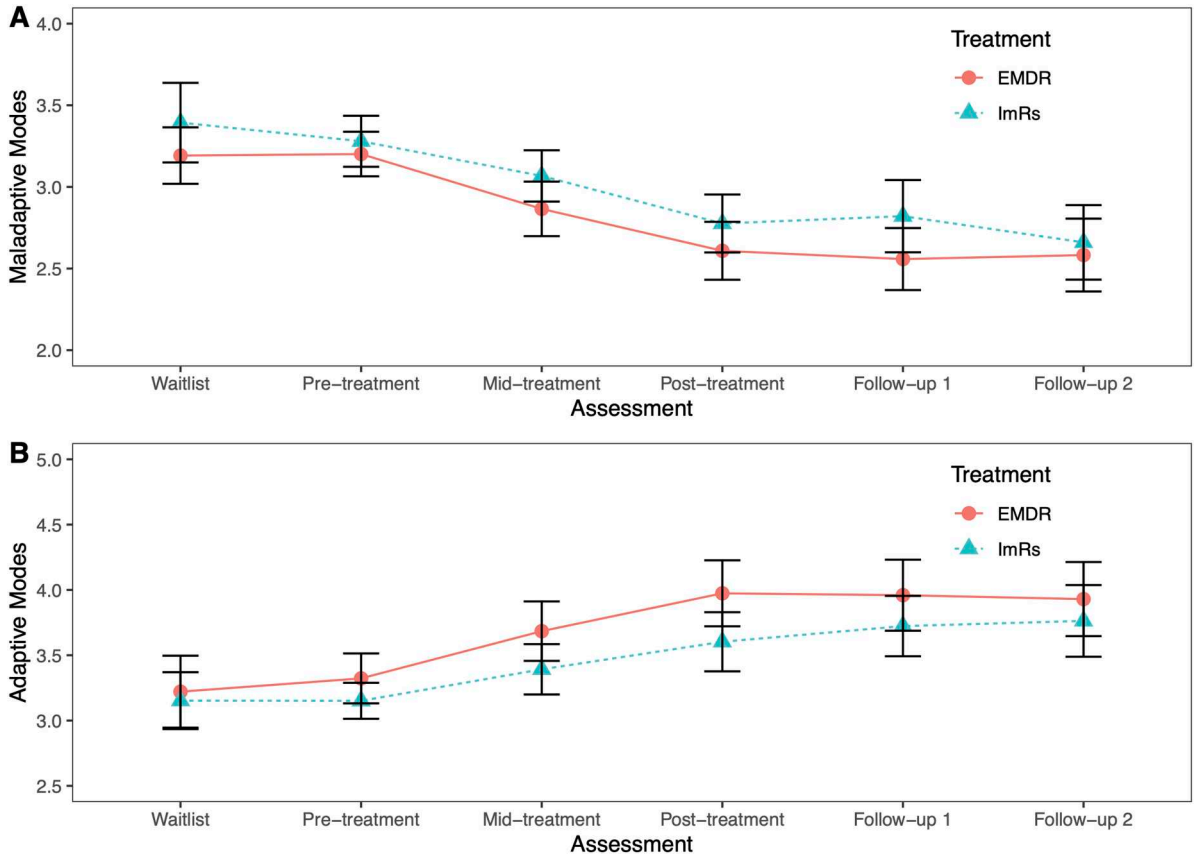

Figure 1. The Change in Maladaptive Schema Modes (A) and Adaptive Schema Modes (B) from Waitlist to the Second Follow-up Assessment, per Treatment Condition.

Note. The error bars indicate the 95% confidence intervals. EMDR = Eye Movement Desensitization and Reprocessing, ImRs = Imagery Rescripting.

compared to pre-treatment, indicating that at these assessments, the changes were explained by the CAPS-5.

3.3. Exploration specific mode clusters

For all separate Maladaptive Mode Clusters, there was a positive change from mid-treatment to the last follow-up assessment, compared to pre-treatment (see Table 4). For most Mode Clusters, none of the time × treatment interactions were statistically significant. However, for the Avoidant Modes, there were three significant interactions with treatment. Thus, from mid-treatment onwards to the first follow-up assessment, the changes in Avoidant Modes were stronger for EMDR compared to ImRs (see Figure 2). Three of the 24 tested interactions were statistically significant. A binomial test ($n = 24$, $k = 3$, $p = .05$) yielded a 0.12 chance level to find three or more significant effects among 24 tests. Hence at a .05 significance level, it cannot be excluded that the three significant effects were chance findings.

Some changes in the Maladaptive Mode Clusters were explained by changes in the CAPS-5, see

Table 4. Mixed Regression Explorations for the Time and Time*Treatment Effects of Changes in Specific Schema Mode Clusters.

	Time					Time * Treatment				
Assessment	*d*	*t*	df	SE	*p*	*d*	*t*	df	SE	*p*
Avoidant Coping Modes[a]										
Waitlist	0.154	1.963	12	0.052	.073	0.300	1.981	48	0.100	.053
Mid-treatment	−0.424	−5.265	19	0.053	**<.001**[c]	0.383	2.438	103	0.104	**.016**
Posttreatment	−0.956	−9.111	43	0.070	**<.001**	0.425	2.057	106	0.137	**.042**[c]
Follow-up 1	−1.009	−8.516	58	0.079	**<.001**	0.597	2.548	105	0.155	**.012**
Follow-up 2	−1.123	−8.401	65	0.089	**<.001**[c]	0.172	0.651	95	0.176	.517
Overcompensating Modes[a]										
Waitlist	−0.087	−0.978	27	0.061	.337[d]	0.169	1.021	49	0.114	.312
Mid-treatment	−0.209	−3.053	20	0.047	**.006**[c]	0.131	1.067	98	0.085	.288
Posttreatment	−0.420	−4.999	37	0.058	**<.001**	0.081	0.511	103	0.109	.610
Follow-up 1	−0.374	−4.120	51	0.063	**<.001**[c]	0.218	1.277	100	0.119	.205
Follow-up 2	−0.483	−4.724	59	0.071	**<.001**	0.076	0.393	100	0.135	.695
Dysfunctional Parent Modes[a]										
Waitlist	0.123	1.500	27	0.065	.145	0.195	1.208	48	0.128	.233
Mid-treatment	−0.340	−4.808	33	0.056	**<.001**[c]	0.166	1.195	103	0.110	.235
Posttreatment	−0.820	−8.995	46	0.065	**<.001**	0.101	0.622	104	0.129	.535
Follow-up 1	−0.778	−8.898	59	0.069	**<.001**	0.234	1.350	104	0.137	.180
Follow-up 2	−0.794	−8.019	64	0.078	**<.001**[c]	−0.113	−0.573	100	0.155	.568
Vulnerable Child Mode[b]										
Waitlist	0.146	1.717	51	0.083	.092	0.176	1.033	51	0.166	.306
Mid-treatment	−0.536	−6.491	104	0.081	**<.001**	0.121	0.731	104	0.162	.466
Posttreatment	−0.851	−8.552	106	0.097	**<.001**[c]	0.032	0.160	106	0.195	.873
Follow-up 1	−0.895	−8.527	105	0.103	**<.001**[c]	0.013	0.061	105	0.205	.951
Follow-up 2	−0.975	−8.710	94	0.109	**<.001**[c]	−0.339	−1.517	94	0.219	.133
Overcontrolling Modes[a]										
Waitlist	0.056	0.759	9	0.052	.468	−0.124	−0.872	50	0.102	.387
Mid-treatment	−0.316	−4.144	15	0.055	**.001**[c]	0.123	0.823	101	0.107	.413
Posttreatment	−0.725	−7.125	34	0.073	**<.001**	0.183	0.910	102	0.144	.365
Follow-up 1	−0.763	−6.859	51	0.080	**<.001**[c]	0.328	1.487	102	0.158	.140
Follow-up 2	−0.906	−7.311	54	0.089	**<.001**	−0.183	−0.741	97	0.176	.460
Externalizing Child Modes[a]										
Waitlist	0.085	0.833	16	0.060	.417	0.201	0.225	46	0.082	.823
Mid-treatment	−0.497	−4.824	42	0.060	**<.001**	0.217	1.531	88	0.083	.129
Posttreatment	−0.896	−6.472	69	0.081	**<.001**	0.268	1.382	100	0.113	.170
Follow-up 1	−0.842	−5.832	74	0.084	**<.001**[c]	0.249	1.224	97	0.119	.224
Follow-up 2	−0.799	−4.834	85	0.097	**<.001**[c]	−0.017	−0.071	99	0.136	.943

Note. *d* = Cohen's *d*. Significant effects indicated in bold. [a] Random effect time, no random intercept, unstructured. [b] Random intercept, unstructured. [c] After controlling for the CAPS-5, these effects were no longer significant. [d] After controlling for the CAPS-5, this effect became significant.

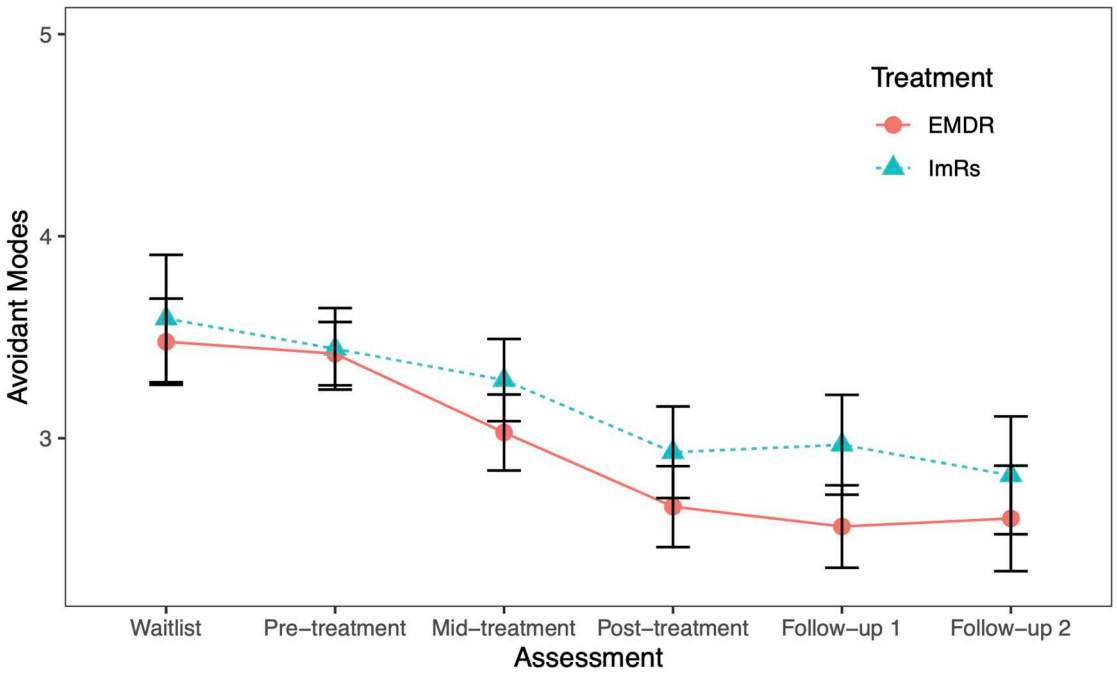

Figure 2. Depiction of the Interaction of Time*Treatment in Avoidant Modes over the Course of Treatment.

Note: The error bars indicate the 95% confidence intervals. EMDR = Eye Movement Desensitization and Reprocessing, ImRs = Imagery Rescripting.

Table 4. First, the time × treatment interaction at the posttreatment assessment for the Avoidant Modes was no longer significant. At mid-treatment, after controlling for the CAPS-5, there was only a positive change for the Child Modes. At posttreatment, nearly all changes of the Mode Clusters remained significant, except for the Vulnerable Child Mode. Most of the changes lost their significance at 1-year follow-up, except for the Overcontrolling and Overcompensating Modes.

In total, after controlling for severity of PTSD symptoms assessed with the CAPS-5, 11 of the 24 decreases in Maladaptive Schema Mode Clusters remained significant. A binomial test indicated that the chance to find 11 significant effects at a .05 significance level among 24 tests was significant, $p < .0001$. Thus, it is unlikely that all decreases in Schema Modes can be understood as consequences of decreases in CAPS-5 scores.

4. Discussion

The present study investigated the effectiveness of ImRs and EMDR for Ch-PTSD on changing Schema Modes. Our findings demonstrated that both ImRs and EMDR were associated with large reductions in Maladaptive Schema Modes and improvements in Adaptive Schema Modes, supporting the idea that these TFT treatments not only reduce the Ch-PTSD but also the comorbid personality pathology. The lack of change during waitlist suggested a causal effect of treatment.

The effect sizes we observed in the present study are comparable with or even stronger than the effect sizes reported in a systematic review on the effectiveness of schema therapy in studies with PDs (Taylor et al., 2017). Additionally, our findings are in line with other studies examining the effect of TFT on comorbid personality pathology (De Jongh et al., 2020; Kleindienst et al., 2021; Kolthof et al., 2022; Van den End et al., 2024). They found co-occurring symptom reductions in PTSD as well as in personality pathology, with effect sizes ranging from $d = 0.50$ to $d = 2.90$ for the reduction of the comorbid personality pathology. The mean scores on the Adaptive and Maladaptive modes in this study ameliorate from a level comparable to a clinical PD-population at pretreatment towards a posttreatment score that falls between the non-clinical ($M = 4.49$ for Adaptive Modes; $M = 2.04$ for Maladaptive Modes) and clinical population ($M = 3.00$ for both Adaptive and Maladaptive) (Bamelis et al., 2011).

Furthermore, we did not find differences in the effectiveness of ImRs versus EMDR on Adaptive and Maladaptive Schema Modes, similar to the lack of differential effects of both treatments on primary and secondary outcomes in the main study (Boterhoven de Haan et al., 2020). When we explored the Maladaptive Mode Clusters we found no difference between ImRs and EMDR in nearly all Modes. Interestingly, the only difference that emerged was that EMDR appeared more effective in reducing Avoidant Coping Modes up until 8-week follow-up. However, this difference disappeared at 1-year follow-up, which showed no significant difference between EMDR and ImRs. Because EMDR is explicitly focused on targeting the most distressing picture and thereby stopping the avoidance coping, whereas the protocol of ImRs is less explicit on this issue, this might explain the initial difference in efficacy on the Avoidant Coping Modes. It should be noted however that it cannot be excluded that the difference between the treatments was a chance finding, as the significance level was not controlled for the number of tests and a binomial test of the number of significant findings given the number of tests failed to reach significance.

The finding that Schema Modes decreased alongside a reduction in PTSD severity might be related to the overlap in the aetiology of PTSD and personality pathology where childhood trauma plays an important role (Carr et al., 2013) as well as the symptom overlap between these pathologies. For example, emotional dysregulation is a core feature in both Ch-PTSD and personality pathology (Dvir et al., 2014). Also, PTSD is more likely to develop after traumatization in those who experience a lack of social support and has a negative impact on interpersonal functioning (Wang et al., 2021). By reducing Ch-PTSD symptoms (i.e. social withdrawal, flashbacks), the availability of resources of social support might increase as attention is shifted to the patient's current surroundings, thereby ameliorating interpersonal functioning, one of the core issues in personality pathology. However, although there is an intertwining of PTSD and Schema Modes, changes in PTSD severity did not account completely for changes in Schema Modes, as the analysis with the CAPS-5 as an additional running covariate indicated. In the early phases of treatment, the Child Modes decreased independent from changes in PTSD severity. At posttreatment, nearly all Schema Mode changes were independent of changes in PTSD severity, suggesting that both treatments directly led to changes in Schema Modes. Moreover, Schema Modes may play a role in the change processes leading to the reduction of PTSD symptoms. Interestingly, at 1-year follow-up, only the Overcompensating and Overcontrolling Modes changes were independent of the CAPS-5, which could indicate the distinctiveness of these Modes from PTSD pathology.

Further research on underlying working mechanisms could improve our understanding of how these treatments change Schema Modes. In ImRs, the

expression and fulfilment of childhood needs can be one of the important factors (Arntz et al., 2014; Koetsier et al., 2024). For example, by focusing on soothing the emotions of the child and fighting critical caregivers in the imagery of the trauma memory, Child and Dysfunctional Parent Modes might be reduced. In EMDR, the intensity of negative emotions decreases by directly activating the most distressing moments while taxing the working memory (see the working memory theory (Gunter & Bodner, 2008)). This might account for the reduction of Child Modes and, as earlier mentioned, of the Avoidant Coping Modes. Next, addressing negative cognitions and installing more positive cognitions might change Dysfunctional Parent Modes and strengthen Adaptive Modes (e.g. the Healthy Adult). It is noteworthy that both treatments also addressed adverse childhood memories that did not meet the trauma definition of the DSM-5 PTSD diagnosis yet were of importance for the patient. This broader focus might also have contributed to the changes in Schema Modes.

There are a few limitations of this study. First of all, the absence of an inactive control group prohibits a firm conclusion that the treatments cause changes in Schema Modes, although the lack of changes during the waitlist period indicates that the observed changes can be attributed to treatment. Second, the absence of a non-trauma-focused active treatment control condition means that we cannot preclude that any active treatment would have led to similar changes in Schema Modes. Third, we measured Schema Modes with the SMI-143, a self-report questionnaire, which may be sensitive to biases in reporting. For example, Bamelis et al. (2011) found that patients, especially patients with strong overcompensating Modes (e.g. histrionic, narcissistic, and obsessive-compulsive PD), underreport Child and Parent Modes on the SMI. Another limitation related to this issue is that Schema Modes are a proxy measure of personality pathology. Although based on theory and supported with empirical directions, this nevertheless is an assumption, and it would have been preferable to use a second measurement of the personality pathology, for example the Assessment of DSM-IV Personality Disorders questionnaire (Schotte et al., 1998). Fourth, we were not able to control for the effect of the treatments on the general level of distress, as this was not assessed separately. However, as PTSD was the main diagnosis and effect sizes were highest on the CAPS-5, we believe that the CAPS-5 was the most suitable to control for change in distress. Fifth, we had to estimate the mid-treatment score of the CAPS-5 by linear interpolation. Although an actual measurement would have been preferable, this was not possible due to limitations in the additional burden on patients and the time frame of the CAPS-5, which focuses on the last month.

This study has important clinical implications. Because of the relatively large effect sizes on the comorbid Schema Modes, even with relatively brief therapy, we recommend in clinical practice to evaluate comorbid personality pathology after patients with Ch-PTSD and comorbid personality problems have received PTSD treatment. In many cases, treatment might already have had a large effect on personality pathology, making further treatment unnecessary. This is consistent with the earlier mentioned study of Van den End and colleagues (2024) who found no significant difference between a combined TFT + PD treatment and TFT alone in the reduction of both PTSD severity and PD symptoms. They also suggested a stepped-care approach, starting with TFT and only adding PD treatment afterward if necessary. These findings are also in line with other studies on the treatment of childhood-related (complex) PTSD, where treatment of PTSD with Prolonged Exposure has been shown to lead to reductions in symptoms that overlap with personality pathology (e.g. emotion regulation difficulties, interpersonal problems, negative self-concept) (Jerud et al., 2014; Jerud et al., 2016; Oprel et al., 2021; Van Toorenburg et al., 2020). Probably all trauma-focused treatments are effective treatments for change in comorbid personality pathology, so in clinical practice, therapists can offer a choice and patients can choose the preferred treatment. Future research on the effectiveness of PD-focused treatment versus TFT for patients with Ch-PTSD and comorbid personality pathology is necessary to strengthen the evidence and to research which TFT is the most cost-effective treatment for this population.

To our knowledge, this is the first study comparing the effects of two trauma-focused treatments of Ch-PTSD on improving Schema Modes, showing both ImRs and EMDR to be effective, and indicating that these treatments reduce comorbid personality pathology. Further research is warranted, not only to replicate these findings but also to investigate the mechanisms of change in the treatment of Ch-PTSD and comorbid personality pathology. In this way, the treatment protocols can be more specifically adjusted to this challenging patient group.

Disclosure statement

A.A. publishes scientific articles and books about ImRs, and offers workshops on this treatment. E.F. has received personal fees from publishing articles, books, and videos and providing workshops and lectures on ImRs, schema therapy, and other experiential techniques. M.D. offers training in schema therapy. M.L.M. receives personal fees for training and supervision in trauma-focused treatments, CBT, ImRs, and EMDR. The remaining authors declare that they have no competing interests.

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Data availability statement

Because participants did not give explicit permission to share data with other researchers, the data cannot be shared given the current EU General Data Protection Regulation.

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