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Non-fear emotions in changes in posttraumatic stress disorder symptoms during treatment☆

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ABSTRACT

Background and objectives: Posttraumatic stress disorder (PTSD) is not only associated with fear but also with other emotions. The present study aimed to examine if changes in shame, guilt, anger, and disgust predicted changes in PTSD symptoms during treatment, while also testing if PTSD symptoms, in turn, predicted changes in these emotions.

Methods: Participants (N = 155) with childhood-related PTSD received a maximum of 12 sessions of eye movement desensitization and reprocessing or imagery rescripting. The data was analyzed using Granger causality models across 12 treatment sessions and 6 assessment sessions (up until one year after the start of treatment). Differences between the two treatments were explored.

Results: Across treatment sessions, shame, and disgust showed a reciprocal relationship with PTSD symptoms, while changes in guilt preceded PTSD symptoms. Across assessments, anger was reciprocally related to PTSD, suggesting that anger might play a more important role in the longer term.

Limitations: The individual emotion items were not yet validated, and the CAPS was not administered at all assessments.

Conclusions: These findings partly differ from earlier studies that suggested a unidirectional relationship in which changes in emotions preceded changes in PTSD symptoms during treatment. This is in line with the idea that non-fear emotions do play an important role in the treatment of PTSD and constitute an important focus of treatment and further research.

1. Introduction

Traditionally, posttraumatic stress disorder (PTSD) is strongly associated with the experience of fear (Brewin et al., 2009), but the emphasis on the experience of non-fear emotions is increasing. For example, the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) included the experience of anger. Moreover, in the DSM-5 patients no longer need to experience fear during the traumatic event to receive the diagnosis. Additionally, the D4 criterion was added which allows for the experience of a wider range of emotions after the traumatic event, including fear, horror, anger, guilt, or shame (American Psychiatric Association, 2013). While patients with PTSD experience a wide range of emotions in response to traumatic events (Hathaway et al., 2010), victims of interpersonal trauma more often meet criterion D4 than victims of non-interpersonal trauma (Badour et al., 2017). In addition, childhood trauma (CT), often interpersonal, can trigger a complex and severe constellation of symptoms (Briere et al., 2008; Ogle et al., 2013). Therefore, it is relevant to study the associations of these emotions with childhood-related PTSD (Ch-PTSD) and to study their possible role during treatment in greater detail.

One emotion that may play an important role in PTSD is anger (McHugh et al., 2012; Olatunji et al., 2010). Both recent stressors and CT are linked to anger and PTSD (Burns et al., 2010; de Bles et al., 2023; Glück et al., 2017; Seok et al., 2020), and in patients with chronic PTSD, anger was one of the strongest experienced emotions after fear (Grey & Holmes, 2008). Higher feelings of anger also predict higher PTSD severity (Orth & Maercker, 2009; Orth & Wieland, 2006) and lower treatment outcomes (Galovski et al., 2014). Additionally, CT is related to disgust (Powell et al., 2015). Many survivors of sexual abuse experience disgust which also predicts PTSD severity (Badour & Feldner, 2018;

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Badour, Feldner, Babson, et al., 2013; Badour, Feldner, Blumenthal, & Knapp, 2013; Coyle et al., 2014; Engelhard et al., 2011), although this is not always replicated (Rüsch et al., 2011). Moreover, changes in disgust positively predict PTSD symptom improvement (Badour & Feldner, 2016). Interestingly, while disgust may play a role in PTSD, the D4 criterion currently does not include this emotion.

Furthermore, CT is related to shame and guilt in adulthood (Kealy et al., 2018; Reid, 2018). Shame is important in the development of PTSD related to interpersonal traumas (laBash & Papa, 2014), and PTSD patients often experience high levels of shame (Harman & Lee, 2010). Both shame and guilt predict PTSD severity (Beck et al., 2011; Robinaugh & McNally, 2010; Saraiya & Lopez-Castro, 2016; Øktedalen et al., 2015), although according to a meta-analysis, shame is more strongly related to PTSD than guilt (Shi et al., 2021). Both emotions are associated with treatment dropout and intrusions (Lee et al., 2001), and changes in shame predicted PTSD symptom change (Matloub (Lepak) et al., 2023). Interestingly, higher guilt, and not anger, predicted higher treatment outcomes, although both emotions were not related to PTSD severity (Clifton et al., 2017). Thus, non-fear emotions are related to CT, higher severity of PTSD, and treatment outcomes.

During treatment, patients may experience difficulties if they experience strong emotions, leading them to avoid talking about certain aspects of their experiences (Allard et al., 2018; Lee et al., 2001; Matloub (Lepak) et al., 2023) or to be reluctant to activate certain aspects of the memory, which negatively impacts trauma processing. In addition, individuals can become less engaged or too emotional during treatment (Held et al., 2011). Targeting emotions during treatment may therefore drive symptom change. Several studies have examined PTSD-related cognitions, such as self-blame and negative worldviews, and generally conclude that changes in negative cognitions precede PTSD symptom reductions both at the next session and over longer time intervals (Cooper et al., 2017; Kleim et al., 2013; Kumpula et al., 2017; McLean et al., 2015; Schumm et al., 2015; Zalta et al., 2014). As posttraumatic cognitions also include emotions such as shame and guilt (Brown et al., 2019) and such emotions are related to negative cognitions (Beck et al., 2015), these findings may also support the role of non-fear emotions. Interestingly, changes in guilt ratings preceded PTSD symptom decrease during cognitive trauma therapy (Allard et al., 2018). Similarly, changes in shame and guilt preceded changes in PTSD symptoms three days later during imagery rescripting (ImRs) and imagery exposure (IE) (Øktedalen et al., 2015).

To our knowledge, research mainly focused on negative posttraumatic cognitions (Brown et al., 2019). Both studies in which the roles of shame and guilt were examined (Allard et al., 2018; Øktedalen et al., 2015) were focused on the treatment of adult traumas. Therefore, there is a need to further examine the role of non-fear emotions, including anger and disgust, in the treatment of Ch-PTSD (McLean & Foa, 2017). The first aim of this study was to examine the time-lagged relationships between four non-fear emotions (i.e., shame, guilt, anger, and disgust) and PTSD severity during and after treatment of Ch-PTSD. A second aim was to explore which emotions were essential in predicting PTSD symptom change. We studied the time-lagged relationships of the combined effects of eye movement desensitization and reprocessing (EMDR) and ImRs as part of a trial comparing the effectiveness of these treatments. A third aim was to explore if the time-lagged relationships differed between these treatments. Fourth, we explored if the findings generalized across PTSD measures and other types of trauma and stressful experiences.

Based on the existing literature (Allard et al., 2018; Cooper et al., 2017; Kleim et al., 2013; McLean et al., 2015; Zalta et al., 2014; Øktedalen et al., 2015), we hypothesized that shame and guilt preceded changes in PTSD symptoms. The roles of anger and disgust during treatment were examined exploratively as no prior studies on these emotions as change mechanisms were conducted.

Table 1
Demographic variables of the complete sample (N = 155).

Variable	N (%)
Age *(M, SD)*	38.54 (11.17)
Proportion males	36 (23.2%)
Country of testing	
the Netherlands	92 (59.4%)
Germany	22 (14.2%)
Australia	41 (26.5%)
Comorbidity	
Mood disorder	111 (71.6%)
Anxiety disorder	87 (56.1%)
Obsessive-compulsive disorder	20 (12.9%)
Eating disorder	21 (13.5%)

2. Methods

The methods, hypotheses and analytic strategy of the present study were preregistered, see [https://osf.io/q2dyp/?view_only=f9f5a6b749a24866ae20a6f23df217f9].

2.1. Participants

Participants (N = 155) were recruited within clinical sites in the Netherlands, Germany, and Australia (see Table 1). Eighty-one participants (52.3%) received EMDR and 74 (47.7%) received ImRs (see Fig. 1 and Table 1). Participants were included if they: (1) had experienced their index trauma (i.e., worst traumatic event) before the age of 16 and had a primary PTSD diagnosis with a duration of more than 3 months at the screening assessment as diagnosed with the Structured Clinical Diagnostic Interview for DSM-IV-TR (First et al., 1995) or the Mini International Neuropsychiatric Interview (Sheehan et al., 1997), (2) were available for the scheduled treatment sessions and assessments, (3) had sufficient linguistic proficiency, and (4) were on a stable dose (i.e., at least three weeks) of medication. Participants were excluded if they: (1) had a comorbid psychotic disorder, bipolar disorder, or a comorbid alcohol or drug dependence, (2) had an IQ below 80 as participants needed to have sufficient understanding of the treatments and the study assessments, (3) showed acute suicide risk, (4) experienced a recent traumatic event in the past six months, and (5) used benzodiazepines (unless they remained abstinent for two weeks).

2.2. Materials

2.2.1. Self-reported PTSD severity

PTSD severity was assessed with the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1997), adapted to assess symptoms since the last session or over the past seven days. The IES-R consists of 22 items, rated on a 5-point Likert scale (0 = not at all to 4 = extremely). The IES-R items were administered twice, referring to (1) the index trauma and (2) all other traumas excluding the index trauma. Previous research showed that the IES-R subscales have high reliability (α between 0.85 and 0.95) and supported its validity (Beck et al., 2008). The reliabilities of the total sum scores in the present study were high (for the IES-R index trauma scale between α = 0.88 and 0.98, and for the IES-R other trauma scale between α = 0.93 and α = 0.98).

2.2.2. Interview-rated PTSD severity

Interview-rated PTSD severity was assessed with the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5; Weathers et al., 2013a), a semi-structured clinical interview consisting of 20 items that evaluate the DSM-5 PTSD criteria during the past month. Each symptom received a severity score between 0 and 4. The internal consistency and validity of the CAPS-5 are good (Boeschoten et al., 2018; Weathers et al., 2018). In the present study, the reliabilities across the different assessments for the total sum scores (between α = 0.80 and α = 0.93) were high.

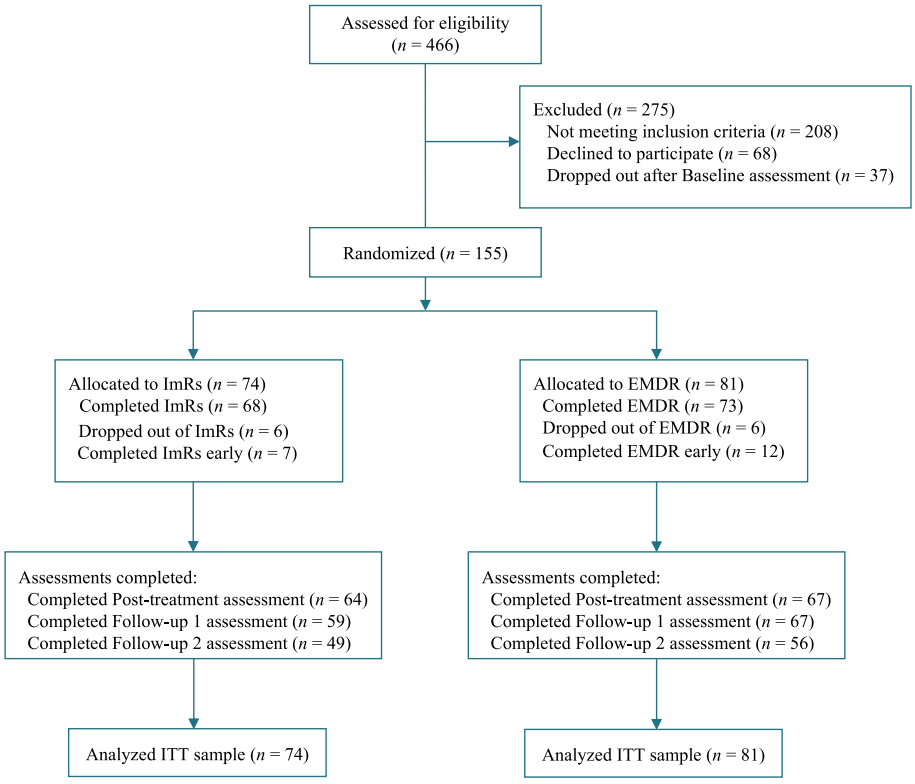

Fig. 1. CONSORT flow chart of the participants in the IREM trial.

2.2.3. *Self-reported non-fear emotions*

Four additional items of the IES-R assessed shame, guilt, anger, and disgust (see Appendix A). As in the IES-R, these items were rated on a 5-point Likert scale (0 = not at all to 4 = extremely) and were assessed for both the index trauma and all other traumas excluding the index trauma.

2.2.4. *Self-reported guilt*

The *Trauma-Related Guilt Inventory* (TRGI; Kubany et al., 1996) measures guilt and consists of 32 items rated on a 5-point Likert scale (1 = not at all true to 5 = extremely true). It consists of four subscales including one distress scale and three cognitive scales. For the present study, the mean score of the hindsight bias and wrongdoing subscales was used to remain consistent with the methods of the main study (Boterhoven de Haan et al., 2020). The TRGI subscales have a high internal consistency (between α = 0.87 and α = 0.90) and a test-retest reliability between 0.84 and 0.86 (Kubany et al., 1996). The reliability of the TRGI in the present study was high (between α = 0.86 and α = 0.90).

2.2.5. *Self-reported shame*

The *Trauma-Related Shame Inventory* (TRSI; Øktedalen et al., 2014) measures shame and consists of 24 items that are rated on a 4-point Likert scale (1 = not at all true for me to 4 = completely true for me). The TRSI includes both internal and external shame (how others view

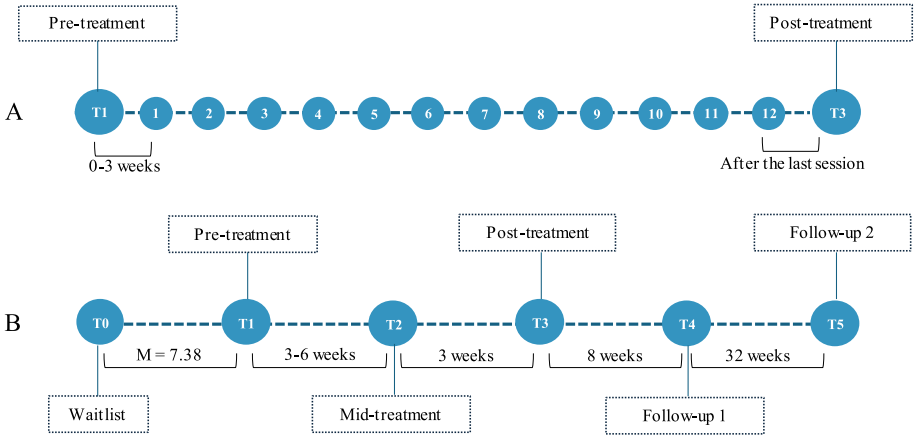

Fig. 2. Overview of the Included Assessment in the Two Different Analyses.
Note. A: Overview of assessments and sessions included in the session-by-session analyses (conducted on the IES-R and IES-R individual emotion items). B: Overview of assessments that were included in the assessment-by-assessment analyses (using the TRSI, TRGI, SCL-90 Hostility, IES-R disgust item, IES-R, and CAPS-5). Follow-up 1 = Follow-up assessment 8 weeks post-treatment, Follow-up 2 = one year after pre-treatment. The IES-R was administered twice (i.e., concerning the index trauma and to all other traumas), but for each model, we made sure that the trauma type of the emotions and IES-R scores were congruent (e.g., IES-R index trauma and the guilt item referring to the index trauma) and we did not run models on incongruent IES-R trauma types.

you), but also condemnation and cognitive-behavioral components (Grau et al., 2021), and has an internal consistency of α = 0.87 (Øktedalen et al., 2014). The reliability of the TRSI total score in the present study was very high and fell between α = 0.94 and α = 0.98.

2.2.6. Self-reported anger

Anger was assessed with the hostility subscale of the *Symptom Checklist-90-R* (SCL-90-R; Derogatis & Unger, 2010 which consists of 6 items that are rated on a 5-point Likert scale (0 = not at all to 4 = extremely). The reliability and validity are acceptable (Cavalcanti et al., 2019; Derogatis et al., 1976), and for the present study, the reliabilities of the total score fell between α = 0.82 and α = 0.88.

2.3. Procedure

This study is a secondary analysis of the IREM trial (trial registration: ACTRN12614000750684) that compared the effectiveness of EMDR and ImRs. A detailed description of all procedures is published in the trial protocol and the main outcome article (Boterhoven de Haan et al., 2017, 2020). The project received ethical approval in all countries and inclusion ran from October 2014 and June 2019. All participants received an information letter and signed an informed consent form. We used the Life Events Checklist to assess exposure to traumatic events and to determine the index trauma (Weathers et al., 2013b). After inclusion, a pre-treatment assessment was administered. If the time before the start of treatment exceeded three weeks, an additional waitlist assessment was administered. Halfway through treatment, a mid-treatment assessment took place. The post-treatment assessment was administered after the 12th treatment session, the first follow-up assessment 8 weeks after the 12th session, and the second follow-up assessment 52 weeks after the first session. All assessments were conducted by trained, independent research assistants who were blind to treatment conditions. Participants were randomly allocated to EMDR or ImRs by an independent research assistant using block randomization with a randomized block size of two, four, and six, stratified on gender.

At each time point, participants completed the IES-R and the individual IES-R emotion items. For the assessment-by-assessment analyses (including all assessments), both the IES-R and the CAPS-5 were used to measure PTSD severity. However, in contrast to the IES-R, the CAPS-5 was not administered at the mid-treatment assessment (see Fig. 2).

2.4. Treatments

Treatment consisted of a maximum of 12 individual 90-min face-to-face sessions delivered twice a week (see Appendix A). Early successful treatment termination was allowed. EMDR treatment was offered according to the Shapiro protocol (Shapiro, 2001) and ImRs was offered according to the Arntz and Weertman protocol (Arntz & Weertman, 1999). All therapists completed training in these protocols and received weekly supervision. Based on the ratings of the recorded sessions, the treatment adherence ratings for EMDR and ImRs were satisfactory.

2.5. Data analysis

We conducted the analyses using R studio with the *nlme* package (Pinheiro et al., 2020). Time causality was tested with the Granger causality test (Granger, 1969) using a linear mixed regression model. We conducted two sets of analyses: session-by-session analyses and assessment-by-assessment analyses. First, for each emotion separately, we tested if the emotion variable at time i predicted PTSD severity at time i+1 and added the autocorrelation of PTSD severity at time i as a covariate. Second, we followed the same steps to test if PTSD severity at time i predicted the change in the emotion at time i+1 (i.e., reverse relationship) while also including the autocorrelation of the emotion variable. Exploratory, we examined if these relationships were moderated by treatment.

All variables were centered at the person level to further prevent between-subject variance from obscuring within-subject processes. To control for the effect of time (e.g., change occurring due to unspecific treatment effects) and a possible non-linear trend in time (especially for the assessment-by-assessment analyses), we added a natural spline of time as a covariate (R Core Team, 2020). Splines can be used to split a function in different knots and fit a polynomial function that is continuous at each knot. These splines were fitted with two degrees of freedom (df), but the optimal df was also examined by using a leave-one-out validation, repeated 10 times, on a random training sample of 10% of the participants from whom data from at least two assessments was available. In case several of these cross-validations indicated that the optimal df was higher than 2 (i.e., 4, 5, or 6), we examined if this influenced the results. All models were fitted with random slopes of time, using the natural spline of time with the same df.

Lastly, we explored the optimized combination of emotion predictors using multi-model inference with which all possible combinations of predictors were fitted and ranked based on the Bayesian Information Criterion (BIC) using the *MuMin* package (Bartoń, 2019). If the BIC difference between the best models was <2, we examined the log-likelihood. If the models were equivalent, we chose the most parsimonious model. The spline of time and the autocorrelation predictor were always included in each model.

We corrected for multiple testing by dividing alpha (i.e., 0.05) by the number of primary tests (four non-fear emotions), resulting in an alpha level of 0.0125. We calculated the correlation between each fixed predictor and the outcome variable using the following formula: $r = \sqrt{\frac{t^2}{t^2+df}}$ with the df corresponding to the *t*-test. For Cohen's *d,* which represented the effect of each predictor on the outcome, we used the following formula from the R command: $d = \frac{2 * t}{\sqrt{df}}$ using Kenward-Roger df. We tested if the residuals fulfilled the assumptions of linearity, normality, and homoscedasticity. Outliers were defined as Pearson residuals with an absolute value larger than 3 (Blatná, 2006). Unless otherwise specified, removing outliers did not affect the results. The analyses were run on the intent-to-treat sample and missing data was not imputed.

The IES-R contains one item about anger (i.e., item 8), so a sensitivity analysis was conducted on the IES-R scores excluding the anger item. Due to content overlap between several CAPS-5 items and the emotion predictors (i.e., criterion D4 is focused on negative emotions, E1 is focused on anger, and D3 is focused on guilt), we conducted several sensitivity analyses. We removed criterion D4 from the total CAPS-5 score for all analyses. For the analyses including anger and guilt as predictors, we respectively excluded criteria E1 and D3 from the CAPS-5 score. We also examined the correlations between all emotion measures at the pre-treatment assessment.

Using G*power (Faul et al., 2007), we conducted post-hoc power analyses. For the session-by-session analyses, this resulted in a power of 0.98 to detect a small effect size of $d = 0.242$, whereas this resulted in a power of 0.79 for the assessment-by-assessment analyses.

3. Results

The scores of all variables on each session and assessment are shown in the appendices. Between 22.5% and 23.8% of the session data was missing and between 22.2% and 27% of the assessment data was missing. The individual emotion items were moderately to strongly related to the respective questionnaires and these correlations were stronger compared to other relationships. This also applied, in most cases, for the correlations between the emotion items referring to the index trauma and all other traumas (see Table D).

3.1. Session-by-session analyses

In the session-by-session analyses, there was an interval of several days between the assessments. In all models, the IES-R autocorrelations

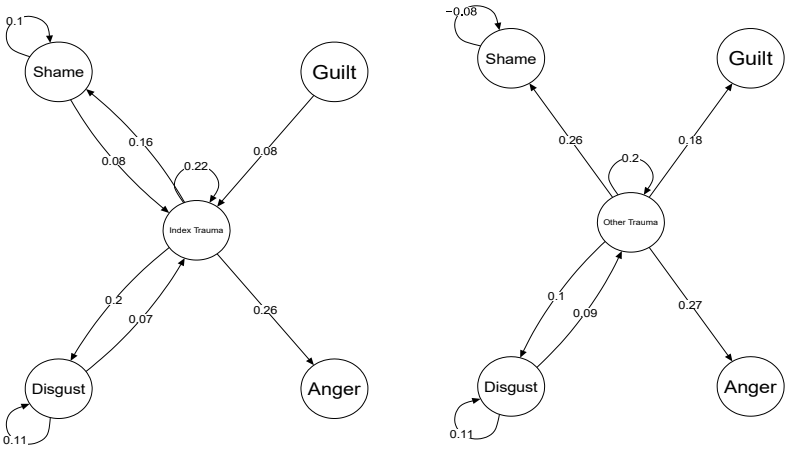

Fig. 3. Graphic Representation of the Significant Session-by-Session Relationships
Note. A: The IES-R Index Trauma; and B: All other traumas. The coefficients represent the standardized beta coefficients. The mean of the PTSD autocorrelations was used in these diagrams.

were significant and positive, so changes in PTSD symptoms predicted subsequent changes in PTSD symptoms. The results are presented in Fig. 3 and Table 2.

3.1.1. Shame

Shame scores significantly predicted the IES-R index trauma score at the next session, while IES-R index scores also predicted shame at the next session. In contrast, while shame did not predict the IES-R other trauma score at the next session, changes in IES-R other trauma scores predicted and thus preceded changes in shame. The reverse relationship between the IES-R other traumas scale and shame was moderated by treatment, $b = 0.009$, $t(1397) = 2.510$, SE = 0.004, $p = 0.012$, 95% CI [0.002, 0.016], indicating that this relationship was stronger for ImRs compared to EMDR. After the removal of outliers, the autocorrelation of shame in the model predicting the IES-R other trauma was non-significant.

3.1.2. Guilt

Changes in guilt preceded changes in the IES-R index trauma scores at the next session, as the reverse effect of IES-R index trauma scores on subsequent guilt scores was non-significant.[1] Changes in guilt did not predict the IES-R other trauma scores, while changes in IES-R other trauma scores significantly preceded changes in guilt. This relationship was moderated by treatment and was stronger for ImRs compared to EMDR, b = 0.013, $t(1396) = 3.862$, SE = 0.003, $p < 0.001$, 95% CI [0.007, 0.020].

3.1.3. Anger

Changes in both IES-R scales preceded changes in anger as anger was not predictive of changes in IES-R scores at the next session, while IES-R scores were positively related to changes in anger.[2] These relationships were not moderated by treatment. In addition, removing the anger item from the IES-R total scores yielded similar results.

3.1.4. Disgust

There was a reciprocal relationship between changes in disgust and both IES-R scores, as disgust was positively related to IES-R scores at the next session, and IES-R scores also predicted subsequent changes in disgust.[3] None of the relationships were moderated by treatment.

3.1.5. Model selection

For the model with the IES-R index trauma, guilt ($\beta = 0.068$) and disgust ($\beta = 0.063$) were included (see Table E). For the IES-R other trauma scale, only disgust ($\beta = 0.088$) was included in the final model.

3.2. Assessment-by-assessment analyses

The results are shown in Fig. 4 and Table 3. Removing the items with content overlap from the CAPS-5 did not influence the results. The time between the different assessments ranged from 3 to 32 weeks.

3.2.1. Shame (TRSI)

For all PTSD outcomes, shame (i.e., TRSI) did not predict changes in PTSD symptoms at the next assessment. The reverse relationships revealed that both IES-R scales, and not the CAPS-5, were positively related to changes in subsequent shame scores. After removing the outliers in the reverse model, IES-R other trauma scores no longer predicted subsequent TRSI scores ($p = 0.042$). The relationship between the IES-R index trauma scale and TRSI scores at the next assessment was stronger for ImRs compared to EMDR, $b = 0.106$, $t(421) = 3.034$, SE = 0.035, $p = 0.003$, 95% CI [0.037, 0.175].

3.2.2. Guilt (TRGI)

Changes in guilt (i.e., TRGI) did not predict changes in PTSD symptoms. Changes in both IES-R scales, and not the CAPS-5, preceded TRGI scores at the next assessment. The relationship between TRGI scores and IES-R other trauma scores at the next assessment was stronger for EMDR compared to ImRs, $b = -4.870$, $t(405) = -2.713$, SE = 1.795, $p = 0.007$, 95% CI [−8.398, 1.342].

3.2.3. Anger (SCL-90-hostility)

Anger (i.e., SCL-90 hostility) positively predicted the IES-R other scores at the next assessment while both IES-R scales were also positively associated with anger at the next assessment. There were no relationships between anger and the CAPS-5 in either direction. After

[1] This result was not robust as the significance level of the effect of the IES-R index trauma on guilt at the next session changed with a higher df used to fit the time splines in the model (i.e., if df was 4, $b = 0.005$, $p = 0.010$; if df was 5, $b = 0.005$, $p = 0.022$). For the IES-R other trauma scores, increasing the df to 6 only influenced some autocorrelations.

[2] Higher degrees of freedom were related to some changes in the autocorrelations, but not the Granger causality effects.

[3] With a df of 5, disgust no longer predicted changes in IES-R index trauma scores ($p = 0.023$). A df of 4 and 5 for the splines had an influence on some of the autocorrelations.

Table 2
Model outcomes of the session-by-session analyses.

Model	*b*	*β*	*T(df)*	SE	Df	*p*	95% CI	*d*	*r*
Shame									
PTSD symptoms (IES-R Index *i*+1) predicted by shame (*i*)									
IES-R Index	0.197	0.207	7.585	0.026	1416	<0.001	[0.146, 0.248]	0.403	0.198
Shame	1.132	0.078	3.674	0.308	1416	<0.001	[0.523, 1.737]	0.195	0.097
Shame (*i*+1) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Shame	0.091	0.097	3.467	0.026	1410	0.001	[0.040, 0.143]	0.185	0.092
IES-R Index	0.010	0.155	4.422	0.002	1410	<0.001	[0.005, 0.014]	0.236	0.117
PTSD symptoms (IES-R Other *i*+1) predicted by shame (*i*)									
IES-R Other	0.209	0.216	7.998	0.026	1405	<0.001	[0.158, 0.260]	0.427	0.209
Shame	0.149	0.010	0.475	0.315	1405	0.635	[-0.468, 0.767]	0.035	0.013
Shame (*i*+1) predicted by PTSD symptoms (IES-R Other Trauma *i*) - *Reverse*									
Shame	−0.073	−0.076	−2.842	0.026	1398	0.005	[-0.123, 0.023]	−0.152	0.076
IES-R Other	0.016	0.260	7.660	0.002	1398	<0.001	[0.012, 0.020]	0.410	0.201
Guilt									
PTSD symptoms (IES-R Index *i*+1) predicted by guilt (*i*)									
IES-R Index	0.202	0.211	7.915	0.025	1415	<0.001	[0.152, 0.251]	0.421	0.206
Guilt	1.254	0.077	3.857	0.325	1415	<0.001	[0.616, 1.891]	0.205	0.102
Guilt (*i*+1) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Guilt	0.042	0.027	1.612	0.026	1408	0.107	[-0.009, 0.093]	0.086	0.043
IES-R Index	0.004	0.036	1.989	0.002	1408	0.047	[0.000, 0.008]	0.106	0.053
PTSD symptoms (IES-R Other *i*+1) predicted by guilt (*i*)									
IES-R Other	0.205	0.212	7.874	0.026	1404	<0.001	[0.154, 0.257]	0.420	0.206
Guilt	0.279	0.018	0.892	0.313	1404	0.372	[-0.334, 0.892]	0.048	0.024
Guilt (*i*+1) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
Guilt	−0.026	−0.026	−0.971	0.026	1397	0.332	[-0.077, 0.026]	−0.052	0.026
IES-R Other	0.011	0.181	5.140	0.002	1397	<0.001	[0.007, 0.015]	0.275	0.136
Anger									
PTSD symptoms (IES-R Index *i*+1) predicted by anger (*i*)									
IES-R Index	0.217	0.227	8.100	0.027	1417	<0.001	[0.164, 0.269]	0.430	0.210
Anger	0.576	0.042	1.920	0.300	1417	0.055	[-0.013, 1.164]	0.102	0.051
Anger (*i*+1) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Anger	0.012	0.013	0.431	0.028	1412	0.667	[-0.043, 0.067]	0.023	0.011
IES-R Index	0.017	0.256	7.045	0.002	1412	<0.001	[0.012, 0.022]	0.375	0.184
PTSD symptoms (IES-R Other *i*+1) predicted by anger (*i*)									
IES-R Other	0.192	0.197	7.034	0.027	1408	<0.001	[0.138, 0.245]	0.375	0.184
Anger	0.513	0.038	1.650	0.311	1408	0.099	[-0.097, 1.122]	0.088	0.044
Anger (*i*+1) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
Anger	−0.045	−0.047	−1.634	0.028	1404	0.102	[-0.099, 0.009]	−0.087	0.044
IES-R Other	0.019	0.270	7.852	0.002	1404	<0.001	[0.014, 0.023]	0.419	0.205
Disgust									
PTSD symptoms (IES-R Index *i*+1) predicted by disgust (*i*)									
IES-R Index	0.211	0.221	8.255	0.026	1417	<0.001	[0.161, 0.261]	0.439	0.214
Disgust	1.017	0.074	3.400	0.299	1417	0.001	[0.430, 1.604]	0.181	0.090
Disgust (*i*+1) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Disgust	0.102	0.110	3.903	0.026	1413	<0.001	[0.051, 0.154]	0.208	0.103
IES-R Index	0.013	0.203	5.965	0.002	1413	<0.001	[0.009, 0.017]	0.317	0.157
PTSD symptoms (IES-R Other *i*+1) predicted by disgust (*i*)									
IES-R Other	0.176	0.182	6.678	0.026	1407	<0.001	[0.125 0.228]	0.356	0.175
Disgust	1.305	0.088	3.864	0.338	1407	<0.001	[0.643, 1.968]	0.206	0.102
Disgust (*i*+1) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
Disgust	0.109	0.114	4.148	0.026	1403	<0.001	[0.057, 0.160]	0.222	0.110
IES-R Other	0.006	0.099	3.008	0.002	1403	<0.001	[0.002, 0.010]	0.161	0.080

Note. IES-R = Impact of Events Scale Revised.

removing outliers, anger no longer predicted subsequent IES-R other scale scores. The reverse relationship between the IES-R index scale and anger scores at the next assessment was larger for ImRs compared to EMDR, $b = 0.036$, $t(423) = 2.553$, SE = 0.014, $p = 0.011$, 95% CI [0.008, 0.064].

3.2.4. Disgust (IES-R)

Disgust and PTSD symptoms were not associated in either direction. None of the relationships were moderated by treatment.

3.2.5. Model selection

For the models with the IES-R index trauma and the CAPS-5 as PTSD severity outcomes, none of the emotion predictors was included (see Table F). For the IES-R other trauma scale, anger was the only included emotion ($\beta = 0.039$).

4. Discussion

The present study aimed to examine the role of four non-fear emotions as processes of change during trauma-focused treatment of Ch-PTSD. We found several important links between changes in shame, guilt, anger, and disgust and changes in PTSD symptoms during and after treatment from session to session and from assessment to assessment.

First, partly consistent with the hypotheses, patients who reported lower shame and disgust also reported lower PTSD symptoms at the next session, but in turn, a lower reporting of PTSD symptoms was also related to less reported shame and disgust at the next session. While shame is directed at the self, disgust can be either directed at the self or others. Based on our measure of disgust we could not distinguish between internal (i.e., self-disgust) and external disgust. However, self-disgust can be expected to be strongly linked to feelings of shame (Jung & Steil, 2012), which could partly explain the similar findings of

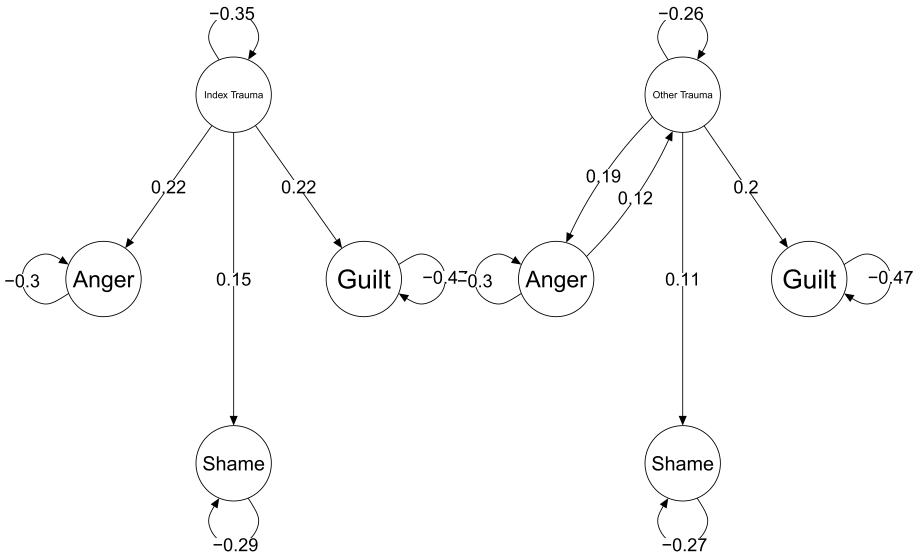

Fig. 4. Graphic Representation of the Significant Assessment-by-Assessment Relationships
Note. A: The IES-R Index Trauma; and B all other traumas. The coefficients represent the standardized beta coefficients. The mean of the PTSD autocorrelations was used in these diagrams. The CAPS-5 is not shown here as no significant relationships with non-fear emotions were observed. The same applies to disgust, which had no significant associations with PTSD symptoms.

these emotions. Both shame and guilt were equally strong predictors of subsequent changes in PTSD symptoms. However, unlike shame, which was reciprocally related to PTSD symptoms across sessions, changes in guilt preceded changes in PTSD symptoms. However, the findings were inconsistent as this was found for PTSD symptoms related to the index trauma. For all other traumas, changes in PTSD symptoms preceded changes in guilt. In addition, based on our model selection procedure, guilt and disgust were selected as the optimal predictors of PTSD symptom change. The stronger role of guilt compared to shame is interesting considering that both emotions are directed at the self. Whereas guilt is focused on behaviors of the self and may stimulate approach behavior, shame is directed at appraisals of the whole self and may stimulate avoidance (Shi et al., 2021; Tracy & Robins, 2004). In contrast, a recent meta-analysis showed similar correlations between shame, guilt, and PTSD severity, although shame without guilt was more strongly related to PTSD than guilt without shame (Shi et al., 2021). Therefore, the role of shame and guilt may depend on whether they co-exist, and shame may play a stronger role in the absence of guilt. However, the correlations between these non-fear emotions and PTSD are no indications of their role in driving symptom change. Thus, nuanced differences between shame and guilt should therefore be studied in more detail, further investigating their unique and differential roles during treatment.

Second, findings from the longer-term assessment-to-assessment changes were not in line with our hypotheses. While anger did not play a role during the treatment period, anger was the only non-fear emotion associated with PTSD symptoms across longer time intervals. This relationship was reciprocal, so a lower reporting of PTSD symptoms was also related to less anger at the next assessment. Changes in PTSD symptoms between the more widely separated assessments may therefore relate to different change processes compared to the more immediate changes in PTSD symptoms during treatment. Relatively late in the treatment process, new insights might emerge that lead to an increase in anger towards significant others (e.g., realizing that one parent was an accomplice in the abuse and failed to offer protection), which after a further decline can consequently have a positive effect on PTSD symptoms in the long run. However, comparable lines of reasoning could be set up for shame, guilt, and disgust. Perhaps guilt, shame, and disgust play a larger role during the active treatment process. In contrast to shame and guilt, anger can both be directed at the self and others. When anger is directed at the self, it is not an externalizing, but internalizing phenomenon. However, the distinction between self- and other-directedness also applies to disgust. Such differences may partly explain these differential findings, and future studies should further examine the difference between emotions directed at the self or others. However, we cannot rule out the possibility that other emotions also had long-term effects as controlling for changes over time, and the longer (and irregular) time intervals between the assessments (i.e., between 3 and 32 weeks), could also have canceled out any effects that occurred over shorter periods between the assessments (i.e., several days on average).

Several studies concluded that changes in posttraumatic cognitions preceded changes in PTSD symptoms (Cooper et al., 2017; Kleim et al., 2013; Kumpula et al., 2017; McLean et al., 2015; Schumm et al., 2015; Zalta et al., 2014). Although the role of negative cognitions may be similar to non-fear emotions, the effects of negative cognitions may be stronger than the effects of individual emotions. However, the finding that guilt is a driving factor of PTSD symptom change during treatment is consistent with the findings of Allard et al. (2018). In contrast, Øktedalen et al. (2015), found support for both shame and guilt as mechanisms of PTSD symptom change. However, both studies used a different analytic strategy, and used more extensive measures of shame and guilt. Additionally, the study of Øktedalen et al. (2015) did not control for the autocorrelations of the different constructs or for the variance between participants, which could have biased the effects. These inconsistencies should be considered when we compare these findings. In addition, the present study focused on Ch-PTSD, while the studies of Allard et al. (2018) and Øktedalen et al. (2015) focused on PTSD related to a wider range of events in adulthood and offered different treatments. Thus, the role of non-fear emotions may be dependent on the type of trauma, although the findings with regard to guilt were similar. Moreover, the experience of strong emotions for both types of traumas (childhood and adulthood) may similarly impact treatment irrespective of the type of trauma and the treatment. However, we should further study the differential role of these emotions in the treatment of Ch-PTSD and adult PTSD.

Interestingly, between sessions, the associations between changes in PTSD symptoms and changes in shame, guilt, and disgust, were stronger for ImRs compared to EMDR. In contrast, the relationship between PTSD symptoms and guilt at the next assessment was stronger for EMDR. This

Table 3
Model outcomes of the assessment-by-assessment analyses.

Model	*b*	*β*	*t*	SE	Df	*p*	95% CI	*d*	*r*
Shame									
PTSD symptoms (IES-R Index *i*+*1*) predicted by shame (TRSI *i*)									
IES-R Index	−0.331	−0.355	−9.309	0.036	411	<0.001	[-0.401, −0.261]	−0.918	0.417
TRSI	0.052	0.033	0.978	0.053	411	0.328	[0.052, 0.156]	0.097	0.048
Shame (TRSI *i*+*1*) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
TRSI	−0.290	−0.289	−8.079	0.036	422	<0.001	[-0.360, 0.219]	−0.787	0.366
IES-R Index	0.088	0.147	3.599	0.024	422	<0.001	[0.039, 0.136]	0.350	0.173
PTSD symptoms (IES-R Other *i*+*1*) predicted by shame (TRSI *i*)									
IES-R Other	−0.262	−0.270	−6.621	0.040	406	<0.001	[-0.340, −0.184]	−0.657	0.312
TRSI	0.062	0.044	1.178	0.053	406	0.240	[-0.042, 0.166]	0.117	0.058
Shame (TRSI *i*+*1*) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
TRSI	−0.270	−0.269	−7.608	0.035	420	<0.001	[-0.339, −0.200]	−0.742	0.348
IES-R Other	0.077	0.110	2.883	0.027	420	0.004	[0.024, 0.129]	0.281	0.139
PTSD symptoms (CAPS-5 *i*+*1*) predicted by shame (TRSI *i*)									
CAPS-5	−0.453	−0.469	−10.318	0.044	289	<0.001	[-0.539, −0.367]	−1.214	0.519
TRSI	0.039	0.039	1.053	0.037	289	0.293	[-0.034, 0.111]	0.124	0.062
Shame (TRSI *i*+*1*) predicted by PTSD symptoms (CAPS *i*) - *Reverse*									
TRSI	−0.434	−0.436	−15.199	0.029	290	<0.001	[-0.491, −0.378]	−1.785	0.666
CAPS-5	0.042	0.044	1.205	0.035	290	0.229	[-0.027, 0.111]	0.142	0.071
Guilt									
PTSD symptoms (IES-R Index *i*+*1*) predicted by guilt (TRGI *i*)									
IES-R Index	−0.327	−0.350	−10.012	0.033	411	<0.001	[-0.391, −0.263]	−0.988	0.443
TRGI	1.098	0.031	1.176	0.934	411	0.240	[-0.738, 2.933]	0.116	0.058
Guilt (TRGI *i*+*1*) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
TRGI	−0.475	−0.469	−13.788	0.034	422	<0.001	[-0.543 -0.407]	−1.342	0.557
IES-R Index	0.006	0.218	4.900	0.001	422	<0.001	[0.004, 0.008]	0.477	0.232
PTSD symptoms (IES-R Other *i*+*1*) predicted by guilt (TRGI *i*)									
IES-R Other	−0.229	−0.236	−6.143	0.037	406	0.001	[-0.302, 0.156]	−0.610	0.292
TRGI	−0.825	−0.026	−0.853	0.967	406	0.394	[-2.727, 1.077]	−0.085	0.042
Guilt (TRGI *i*+*1*) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
TRGI	−0.476	−0.470	−13.766	0.035	420	<0.001	[-0.543, −0.408]	−1.343	0.558
IES-R Other	0.006	0.203	4.783	0.001	420	<0.001	[0.004, 0.009]	0.467	0.227
PTSD symptoms (CAPS-5 *i*+*1*) predicted by guilt (TRGI *i*)									
CAPS-5	−0.463	−0.479	−11.748	0.039	289	<0.001	[-0.540, −0.385]	−1.382	0.569
TRGI	1.303	0.057	1.667	0.782	289	0.097	[-0.236, 2.843]	0.196	0.098
Guilt (TRGI *i*+*1*) predicted by PTSD symptoms (CAPS-5 *i*) - *Reverse*									
TRGI	−0.349	−0.347	−8.226	0.042	290	<0.001	[-0.433, −0.266]	−0.966	0.435
CAPS-5	0.000	−0.003	−0.063	0.002	290	0.950	[-0.004, 0.004]	0.007	0.004
Anger									
PTSD symptoms (IES-R Index *i*+*1*) predicted by anger (Hostility *i*)									
IES-R Index	−0.323	−0.345	−9.951	0.032	411	<0.001	[-0.386, −0.259]	−0.982	0.441
Hostility	0.128	0.024	0.853	0.150	411	0.394	[-0.166, 0.422]	0.084	0.042
Anger (Hostility *i*+*1*) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Hostility	−0.292	−0.305	−7.609	0.038	424	<0.001	[-0.367, −0.217]	−0.739	0.347
IES-R Index	0.038	0.224	4.441	0.009	424	<0.001	[0.021, 0.055]	0.431	0.211
PTSD symptoms (IES-R Other *i*+*1*) predicted by anger (Hostility *i*)									
IES-R Other	−0.284	−0.293	−7.836	0.036	406	<0.001	[-0.356, −0.213]	−0.778	0.362
Hostility	0.543	0.117	3.616	0.150	406	<0.001	[0.248, 0.838]	0.359	0.177
Anger (Hostility *i*+*1*) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
Hostility	−0.287	−0.300	−7.440	0.039	422	<0.001	[-0.363, −0.211]	−0.724	0.341
IES-R Other	0.037	0.187	3.907	0.010	422	<0.001	[0.019, 0.056]	0.380	0.187
PTSD symptoms (CAPS-5 *i*+*1*) predicted by anger (Hostility *i*)									
CAPS-5	−0.417	−0.432	−10.308	0.040	289	<0.001	[-0.496, −0.337]	−1.213	0.518
Hostility	−0.015	−0.004	−0.129	0.120	289	0.897	[-0.251, 0.220]	−0.015	0.008
Anger (Hostility *i*+*1*) predicted by PTSD symptoms (CAPS-5 *i*) - *Reverse*									
Hostility	−0.375	−0.405	−9.492	0.040	291	<0.001	[-0.453, −0.297]	−1.113	0.486
CAPS-5	0.021	0.080	1.543	0.014	291	0.124	[-0.006, 0.048]	0.181	0.090
Disgust									
PTSD symptoms (IES-R Index *i*+*1*) predicted by disgust (*i*)									
IES-R Index	−0.319	−0.341	−8.173	0.039	411	<0.001	[-0.395, −0.242]	−0.806	0.374
Disgust	0.056	0.004	0.111	0.503	411	0.911	[-0.933, 1.045]	0.011	0.005
Disgust (*i*+*1*) predicted by PTSD symptoms (IES-R Index *i*) - *Reverse*									
Disgust	−0.343	−0.376	−8.779	0.039	411	<0.001	[-0.419, −0.266]	−0.866	0.397
IES-R Index	0.004	0.072	1.476	0.003	411	0.141	[-0.001, 0.010]	0.146	0.073
PTSD symptoms (IES-R Other *i*+*1*) predicted by disgust (*i*)									
IES-R Other	−0.233	−0.240	−5.518	0.042	407	<0.001	[-0.316, −0.150]	−0.547	0.264
Disgust	−0.196	0.013	0.367	0.534	407	0.714	[-1.246, 0.854]	−0.036	0.018
Disgust (*i*+*1*) predicted by PTSD symptoms (IES-R Other *i*) - *Reverse*									
Disgust	−0.408	−0.456	−10.534	0.039	407	<0.001	[-0.484, −0.332]	−1.044	0.463
IES-R Other	0.004	0.071	1.355	0.003	407	0.176	[-0.002, 0.010]	0.134	0.067
PTSD symptoms (CAPS-5 *i*+*1*) predicted by disgust (*i*)									
CAPS-5	−0.412	−0.464	−11,454	0.039	289	<0.001	[-0.526, −0.371]	−1.347	0.559
Disgust	0.412	0.046	1.349	0.306	289	0.179	[-0.189, 1.013]	0.159	0.079
Disgust (*i*+*1*) predicted by PTSD symptoms (CAPS-5 *i*) - *Reverse*									
Disgust	−0.433	−0.471	−15.493	0.028	290	<0.001	[-0.488, −0.378]	−1.820	0.673
CAPS-5	0.006	0.058	1.584	0.004	290	0.114	[-0.001, 0.013]	0.186	0.093

Note. IES-R = Impact of Events Scale-Revised, CAPS-5 = Clinician-Administered PTSD Scale for DSM-5, TRSI = Trauma-Related Shame Inventory, TRGI = Trauma-Related Guilt Inventory, Hostility = Symptom Checklist-90 Hostility subscale.

may be explained by differences in the target memory selection of the treatments during the sessions. When arousal drops during EMDR, therapists move on to a different target memory without further attention to the possible meaning of the trauma. In contrast, the ImRs protocol prescribes that the therapist further informs about the child's needs, which may trigger other emotions (e.g., shame) that can be addressed before moving on to the next memory. However, these treatment moderation effects were only observed for the reverse relationships and there were no indications that the relationships between changes in non-fear emotions and subsequent changes in PTSD symptoms differed between EMDR and ImRs. In addition, there were inconsistencies between the treatment effects during the sessions and across assessments. Therefore, these findings are difficult to interpret and cannot be linked to the differential working mechanisms of EMDR and ImRs. Future studies should further examine the differences between these treatments and whether these differences are also dependent on the specific emotions.

The present study has several limitations. First, we assessed emotions with still-to-be-validated individual items. However, it may not always be feasible to administer many extensive questionnaires before each treatment session, and other single-item questionnaires proved valid and reliable (Abdel-Khalek, 2006; Turon et al., 2019), while correlation analyses supported the associations between similar constructs. Second, PTSD diagnoses and the IES-R were based on the DSM-IV criteria, but the CAPS-5 was based on the DSM-5. The DSM-5 also includes the experience of the non-fear emotions included in our study (i.e., D4 criterion). However, this unlikely influenced our patient group, their characteristics (Morina et al., 2014; van Emmerik & Kamphuis, 2011), and our outcomes. Third, the CAPS-5 was administered at fewer assessments compared to the IES-R, which might explain why fewer effects were found for analyses involving the CAPS-5. Fourth, we were not able to assess fear, so an important next step is to examine the relative contributions of fear and non-fear emotions in the treatment of PTSD.

Several key strengths need to be emphasized. We examined changes in individual emotions and PTSD symptoms over short time intervals. As most changes are expected to occur during the treatment period, this provides an important and detailed insight into the processes of change. By also including larger time intervals, we covered both short-term and long-term changes. Also, although correlational, Granger causality models are well-suited to make statements about time causality. By including multiple different measures of the same construct, generalizability across measures was enhanced. Lastly, we controlled for the chance of type-I errors by adjusting the significance threshold.

Our findings have important clinical implications. For example, treatments with a strong focus on fear reduction (e.g., exposure therapy) may become more effective if they include interventions that also focus on non-fear emotions. Although several studies showed that PE also leads to reductions in non-fear emotions and posttraumatic cognitions (e.g., Cooper et al., 2017; Øktedalen et al., 2015), it is also suggested that anger is related to dropout during PE (Rizvi et al., 2009). In addition, these emotions could be more actively used to guide treatment sessions. Furthermore, the role of these emotions provides us with more knowledge about the processes behind the development of PTSD symptoms, which can be used in future studies and the development of theoretical models. An important next step is to examine the relative contributions of fear and non-fear emotions in the treatment of PTSD, which will be the focus of a follow-up replication study.

To conclude, the present study is the first study to examine the relationships between shame, guilt, anger, disgust, and Ch-PTSD symptoms during treatment at this level of detail. Guilt and to a lesser degree shame and disgust, are important processes of change during treatment, while anger may play a more important longer-term role. The exact role that non-fear emotions play in the development and maintenance of PTSD and the extent to which this differs from fear remains open to further investigation. Together, these findings have important clinical implications and underline the importance of monitoring non-fear emotions during treatment.

CRediT authorship contribution statement

Sophie A. Rameckers: Conceptualization, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing. **Arnold A.P. van Emmerik:** Supervision, Writing – review & editing. **Raoul P.P.P. Grasman:** Methodology, Software, Writing – review & editing. **Arnoud Arntz:** Conceptualization, Investigation, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

Dr. Arntz publishes scientific articles and book chapters about ImRs, and occasionally gives workshops. The financial remuneration received go to the University to support research. There are no other conflicts of interest.

Data availability

Data will be made available on request.

Supplementary data/materials

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbtep.2024.101954.

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