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DOI
10.1002/cpp.2855

Publication date
2023

Document Version
Final published version

Published in
Clinical Psychology and Psychotherapy

Citation for published version (APA):
Kuck, S., Arntz, A., Rameckers, S. A., Lee, C. W., Boterhoven de Haan, K. L., Fassbinder, E., & Morina, N. (2023). Intraindividual variability and emotional change as predictors of sudden gains in imagery rescripting and EMDR for PTSD in adult survivors of childhood abuse. *Clinical Psychology and Psychotherapy*, *30*(5), 1029-1046. https://doi.org/10.1002/cpp.2855

Received: 7 January 2023 | Revised: 6 March 2023 | Accepted: 4 April 2023

DOI: 10.1002/cpp.2855

RESEARCH ARTICLE

WILEY

Intraindividual variability and emotional change as predictors of sudden gains in imagery rescripting and EMDR for PTSD in adult survivors of childhood abuse

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Abstract

Sudden gains, defined as large and stable improvements in symptom severity during psychological treatment, have consistently been found to be associated with better outcomes across treatments and diagnoses. Yet, insights on coherent predictors of sudden gains and on emotional changes around sudden gains in post-traumatic stress disorder (PTSD) are lacking. We aimed at replicating a measure of intraindividual variability as a predictor for sudden gains and testing its independence from change during treatment. Furthermore, we expected changes in emotions of guilt, shame and disgust prior to sudden gains to predict sudden gains. Data from a pre-registered randomized controlled trial (RCT) of eye-movement desensitization and reprocessing (emdr) and Imagery Rescripting (ImRs) for PTSD in 155 adult survivors of childhood abuse were used. Intraindividual variability of PTSD symptoms in both treatments did not predict sudden gains status and was not independent of change during treatment. In the EMDR condition, levels of shame during treatment predicted sudden gains and shame decreased shortly before a sudden gain in both treatments. Reductions in all emotions during sudden gains were significantly higher for participants with sudden gains than for comparable intervals in non-sudden gainers. Our findings do not support the predictive validity of intraindividual variability for sudden gains. The decrease of guilt, shame and disgust during sudden gains warrants further research on their role as a mechanism of treatment change for PTSD.

KEYWORDS

eye movement desensitization and reprocessing, imagery rescripting, intraindividual variability, PTSD, sudden gains, trauma-focussed treatment

1 | INTRODUCTION

Scientific interest in sudden changes in symptom severity during psychological treatment has increased over the last few years. In an influential publication, Tang and DeRubeis (1999) introduced a definition of 'sudden gains' comprising the following three criteria: The reduction has to be (1) large in absolute terms, (2) large in relative terms (drop of at least 25% in symptom severity) and (3) stable (symptom severity across the next three treatments sessions being lower than the three sessions before the gain). First described by Tang and

DeRubeis (1999) in relation to cognitive-behavioural therapy (CBT) for depression, sudden gains have been recognized as ubiquitous phenomenon examined across multiple treatments, settings, populations and disorders. In a meta-analysis (Shalom & Aderka, 2020), they were found to be associated with both short- and long-term improvements in therapy outcomes. Yet, the strength of the relationship between sudden gains and treatment outcomes seems to be moderated by the disorder being treated (anxiety disorders and depression showing stronger effects relative to other disorders), the criteria applied to identify sudden gains, the number of treatment sessions and sudden gains' reversal rates (Shalom & Aderka, 2020).

Due to the link of sudden gains with treatment outcomes and motivated by clinical interest in improving psychotherapeutic treatments, much research has focussed on finding coherent predictors of sudden gains. Firstly, Tang and DeRubeis (1999) found higher levels of cognitive changes in sessions prior to sudden gains in CBT for depressive patients. They concluded that cognitive changes, being an important mechanism of cognitive therapy, result in the occurrence of sudden gains and ultimately in an upward spiral of change leading to further cognitive change and an increased therapeutic alliance (Tang et al., 2005; Wiedemann, 2020). Whereas similar findings were reported in some studies for CBT with depressive patients (Tang et al., 2005) and trauma-focussed CBT (Kleim et al., 2013; Wiedemann et al., 2020), other studies on patients suffering from anxiety or depression did not replicate changes of cognitive factors before sudden gains (Bohn et al., 2013; Hofmann et al., 2006; Hunnicutt-Ferguson et al., 2012; Vincent & Norton, 2019; Vittengl et al., 2005), but rather found evidence of cognitive changes following the gain (Bohn et al., 2013). Furthermore, one meta-analysis showed higher frequencies of sudden gains in CBT relative to other treatments (e.g. non-directive supportive therapy, Aderka et al., 2012), while a recent meta-analysis (Shalom & Aderka, 2020) found that type of treatment did not have an influence on the occurrence of sudden gains.

In many studies, clinical characteristics at baseline, age, feelings of hope and ethnicity failed to consistently predict sudden gains or produced contradicting results (see Aderka & Shalom, 2021 for a detailed account). Finally, approaches using machine learning, considering contributions of multiple predictors and their interactions simultaneously, also failed to find significant predictors (Aderka et al., 2021; Zilcha-Mano et al., 2019). Thus, up to now, predicting sudden gains with baseline characteristics has not proven promising, and the factors leading to sudden gains remain uncertain.

Some researchers (e.g. Stiles et al., 2003) have criticized sudden gains as being merely the biggest of random fluctuations which occur independently of treatment effects. Furthermore, in simulation studies, the amount of sudden gains was comparable to the one reported in the literature (Thomas & Persons, 2013; Vittengl et al., 2015). Finally, prediction of treatment outcomes via sudden gains has been criticized for its tautological character, as sudden gains are themselves a form of strong symptom improvement (Stiles et al., 2003). To address this potential limitation, different measures for treatment outcome and sudden gains identification have been applied (Stiles et al., 2003; Vittengl et al., 2015), and more recently, predictors suggested to be independent of treatment improvement were developed (Shalom et al., 2018).

Key Practitioner Message

- Intraindividual variability is not independent of treatment change and not predictive of sudden gains
- Patients with sudden gains have significantly better treatment outcomes at post and follow-up measurements
- Levels of shame at the beginning of treatment predict sudden gains in EMDR
- Emotional change is found directly before and during sudden gains
- Sudden gains occur independently of clinical characteristics at baseline

In this context, a measure of intraindividual variability was proposed to predict sudden gains in four different datasets (Shalom et al., 2018, 2020). The authors found variability to be a significant prediction of sudden gains and claimed that it generalized across treatments, disorders, populations and contexts. Here variability is considered to be orthogonal to, that is, independent of, change during treatment. A revised theory of sudden gains (Aderka & Shalom, 2021) has built on these findings and explained them as a product of natural fluctuations combined with a treatment effect. However, the newer empirical findings by Shalom et al. (2018) warrant replication: up to now, the connection of intraindividual variability with sudden gains was only shown for a selection of treatments (prolonged exposure, psychodynamic therapy and CBT) and for certain samples of patients (obsessive compulsive disorder, children and adolescents with post-traumatic stress disorder [PTSD], 'diverse disorders' in psychodynamic therapy, and social anxiety disorder), and was reported by only one research group. Against this background, the *first aim* of our study was to replicate findings from Shalom et al. (2018) concerning the prediction of sudden gains by intraindividual variability.

As research on cognitive factors and its connection with sudden gains has produced mixed findings, alternative explanations are needed. One possible focus is the change of emotions around sudden gains, which has been neglected so far. This seems striking since emotions and emotion dysregulation play an important role in many psychological disorders (Bradley et al., 2011). In PTSD, a persistent negative emotional state (comprising fear, horror, anger, guilt or shame) is one important characteristic feature of the diagnosis (American Psychiatric Association, 2013), and emotions are very prominent in the distressing contents of trauma memories (Dalgleish & Power, 2004). In this context, guilt and shame are known to be relevant features in PTSD which need to be addressed during treatment (Allard et al., 2018; Beck et al., 2011; Puhalla et al., 2021). Moreover, they seem to have a close link with change processes (Bannister et al., 2019; Shi et al., 2021). Øktedalen et al. (2015) further showed that guilt and shame levels at pre-treatment predicted PTSD levels during treatment; additionally, that changes in guilt and shame during treatment predicted changes in PTSD 3 days later. Finally, Sloan et al. (2021) found predictions of sudden gains by increased expressions of negative emotions in trauma narratives. Disgust is understudied, yet, some evidence suggests that it plays an important role in PTSD and in many cases persists after completion of treatment (Jones et al., 2020). Despite these findings, little is known about the exact role of reductions in guilt, shame and disgust during treatments for PTSD and their interaction with and predictive validity for sudden gains, making exploratory analyses necessary.

Furthermore, there is a lack of knowledge about sudden gains and emotional change processes in two trauma-focussed treatments often applied to treat patients with PTSD: eye-movement desensitization and reprocessing (EMDR) and Imagery Rescripting (ImRs). EMDR and, more recently, ImRs have proven to be effective in reducing PTSD (Boterhoven de Haan et al., 2020; Mavranezouli et al., 2020; Morina et al., 2017). Understanding the mechanisms of change involved in these treatments can foster new research and lead to improvements in their clinical application. To the best of our knowledge, no study has been published on the changes of emotions around sudden gains in ImRs and EMDR for PTSD.

2 | METHOD

2.1 | Participants

This study is a secondary analysis of data from the IREM study (Boterhoven de Haan et al., 2020), which investigated the effectiveness of ImRs and EMDR as treatments for adults with chronic PTSD related to childhood traumas (Ch-PTSD). The sample consisted of 155 patients (*mean age* $= 38.54$, *SD* $= 11.17$) with a primary diagnosis of PTSD (present > 3 months), who had experienced one or multiple traumatic events before the age of 16 (see a detailed description in Boterhoven de Haan et al., 2017, 2020, and Table A1).

2.2 | Treatment

Patients were randomized to receive a maximum of 12 biweekly sessions (90 min each) of either ImRs or EMDR. The EMDR treatment was based on a modified eight-phase protocol developed by Shapiro (2002) and modifications excluded some strategies involving imagery, preventing contamination with ImRs elements. Active trauma processing was achieved using bilateral stimulation and the installation of positive cognitions. ImRs was based on a protocol by Arntz and Weertman (1999), in which the patients are first guided to imagine the beginning of a traumatic event (including sensory impressions, emotions, bodily sensations and cognitions) and to imagine changing the course of events in a helpful way until the needs of their child-self are satisfied. For a detailed description of the protocols, see Boterhoven de Haan et al. (2017, 2020).

2.3 | Measures

The 22-item Impact of Events Scale – Revised (IES-R; Weiss, 2007) was used to measure the severity of PTSD symptoms. It was completed at each treatment session and at the main assessments (pre-treatment, post-treatment, 8-weeks follow-up and 1-year follow-up). Four single emotion items for guilt, shame, anger and disgust were assessed (score range: 0–4), higher scores indicating higher levels of emotions (e.g. *'I felt guilty about the event.'*). In the current study, the single item for anger was not used for detailed analyses due to its confound with items of the IES-R, measuring anger as a facet of PTSD symptoms. Age, sex, months since trauma, comorbid anxiety (yes vs. no), comorbid depression (yes vs. no), pre-treatment scores of the IES-R and self-reported guilt, shame and disgust were included as baseline predictors for sudden gains. All measures used in this secondary study referred to the worst traumatic experience in childhood, which was labelled as 'index trauma' in the original study.

2.4 | Statistical analysis

Data analysis was done in RStudio (RStudio Team, 2020) using R (Version 4.1.1; (R Core Team, 2020), and sudden gains were processed using the R package 'sudden gains' (Wiedemann et al., 2019). The linear mixed models (LMM) were fit with the R Package nlme (Pinheiro et al., 2017) employing the maximum-likelihood estimator. A significance criterion of $\alpha = 0.05$ was set for all analyses.

2.4.1 | Identification and prediction of sudden gains

Sudden gains between session N (pre-gain session) and session $N + 1$ (post-gain session) for the session-based IES-R sum scores were identified by applying the three criteria proposed by Tang and DeRubeis (1999): the first criterion (large gains in absolute terms) was defined by a decrease between two consecutive scores of at least 7.5 (representing a change of 8.5% of the total range of the IES-R). This cut-off was calculated as the standard error of the difference from the reliable change index (RCI; Jacobson & Truax, 1991) as computed by Foa et al. (2002). The second criterion (large gains relative to previous score) was defined by a change of at least 25% on the IES-R, and the third criterion (stability of the gain) was fulfilled when the pooled standard deviation between the mean of the three IES-R scores before the gain (or two if only two available) and after the gain exceeded the following critical values. Based on t-values from the two-sample t test, critical values were adjusted for missingness. A minimum of two of three scores before and after a potential sudden gain had to be available. For the participants with multiple sudden gains, the first was chosen for the analysis. To be able to compare between participants with and without sudden gains (in analogy to Shalom et al., 2018) for subjects without sudden gains, session five was set as a point of comparison, because the average number of pre-gain sessions in sg-subjects was $M = 4.58$ ($SD = 2.38$). Baseline prediction of sudden gain status (yes vs. no) was done by fitting separate univariate logistic regression models for demographic variables (age and sex), baseline psychopathology (months since trauma, PTSD symptoms, comorbid depression and comorbid anxiety) and baseline emotions (guilt, shame and disgust). Treatment condition was added as a moderator for the same models in a second step.

2.4.2 | Treatment outcome and effect sizes

Sudden gains were taken as predictors for treatment outcome by fitting LMMs with pre-treatment PTSD levels as a covariate and with random intercepts for patients. The effects of time (post-treatment, follow-up-1 and follow-up-2) and sudden gain status (sudden gainers vs. non-sudden gainers) and their interaction were added as fixed effects. To investigate the effects of sudden gains on PTSD severity, contrasts were defined for each assessment after treatment. The effect of sudden gains on the treatment outcome was computed using the Cohen's d statistic (Cohen, 1988).

2.4.3 | Computation of intraindividual variability

Intraindividual variability was computed for the IES-R-sum scores as described by Shalom et al. (2018). First, we calculated the change scores between sessions for each patient, took the absolute values and averaged the sum of these change scores, thus obtaining a measure for the average change per intersession interval. Only subjects with values for at least four between-session intervals were included. Data points deviating more than three standard deviations were considered as outliers and removed from the analysis. To test for differences in variability along treatment between sudden gainers and non-sudden gainers, a one-way analysis of variance (ANOVA) was calculated. In a second ANOVA, significant differences in pre-gain variability for sudden gainers and variability along treatment for non-sudden gainers were investigated. This was repeated in a third ANOVA, using pre-gain variability for sudden gainers and only variability of the first five sessions (mean of pre-gain sessions of sg-group) for non-sudden gainers. Separate analyses for the treatment conditions were calculated with a two-way ANOVA. In a last step, logistic regression models were fit to predict sudden gains status (yes vs. no) with pre-gain variability. Change during treatment was defined as the difference between the pre- and post-treatment IES-R scores.

2.4.4 | Emotional change

Prediction of sudden gain status was analysed by multivariate logistic regression models with self-reported guilt, shame and disgust as predictors. In order to exclude the sudden gain itself and its consequences, only values of sessions before a sudden gain were analysed. To grant comparability and equate the number of gains, the calculation for subjects without sudden gains was based on the average session of a sudden gain of the sg-group (as proposed by Shalom et al., 2018). Analyses were repeated for treatment conditions separately. Detailed analyses of emotional changes around sudden gains were done by extracting the values of self-reported guilt, shame and disgust around sudden-gains sessions ($N-2$, $N-1$, N, $N+1$ and $N+2$) and then grouping them into four between-session intervals ($N-2$ to $N-1$, $N-1$ to N, N to $N+1$ and $N+1$ to $N+2$). For each emotion, a separate LMM was computed with time (categorical: the four intervals around sudden gains) and group (sudden gainers vs. non-sudden gainers) as fixed effects and random effects for patients. Contrasts for the differences within and between sudden gain groups were specified for the defined time intervals around sudden gains.

3 | RESULTS

3.1 | Characteristics of sudden gains

In total, 129 patients ($n = 65$ by EMDR, $n = 64$ by ImRs) provided enough data to apply the sudden gains criteria by Tang and DeRubeis (1999) and 1053 between-session intervals were available for the analysis. Seventy-eight out of 155 (50.32%) participants showed a total of 107 sudden gains in the whole sample ($n = 42$ [64.62%] in the EMDR condition and $n = 36$ [56.25%] in the ImRs condition, respectively). The average magnitude of change on the IES-R was 17.56 points ($SD = 7.86$). Sudden gains occurred between sessions 2 and 10 (mean = 5.19, median = 5) with higher frequencies during sessions 2 and 4 in the overall sample. The frequency distribution differed between treatments, with EMDR having two peaks between sessions 2 and 4 and ImRs between sessions 2, 3, 7 and 8, and trajectories of PTSD symptoms around sudden gains were similar for both treatments (see Figure B1). Twenty-six patients (16.77%) experienced multiple gains, of which 23 had two sudden gains (EMDR: 14; ImRs: 9) and three had three sudden gains (EMDR: 1; ImRs: 2). One reversal (loss of at least 50% of the improvement after a sudden gain) was observed in the whole sample.

3.2 | Sudden gains prediction and relationship to treatment outcome

All predictors of sudden gains status (yes vs. no) were non-significant (all *ps* > 0.05; see Table A2). Trajectories of symptom severity from pre-treatment up to the 12-month follow-up differed between patients with and without sudden gains (see Figure B2). Linear mixed models showed that patients with sudden gains reported significantly lower IES-R-scores post-treatment than patients without sudden gains (see Table A3). The effect sizes were large (according to Cohen, 1988) at post-treatment ($d = 1.30$), at follow-up 1 (8 weeks post-treatment, $d = 1.08$) and at follow-up 2 (12 months post-treatment, $d = 0.84$). Analyses conducted separately for the treatment conditions showed larger effect sizes for the effects of sudden gains for ImRs ($d = 0.97$–1.57) than for subjects with EMDR ($d = 0.68$–0.96).

3.3 | Intraindividual variability as a predictor for sudden gains

Subjects had a mean variability of 6.62 ($SD = 2.68$; range: 1.27 to 13.91), meaning that IES-R-scores changed around approximately seven points in absolute numbers per subject during treatment. A significant correlation of moderate intensity (according to Funder & Ozer, 2019) between intraindividual variability and change during treatment was found ($r = 0.25$, $p = 0.005$) and variability and magnitude of sudden gains correlated with a large effect size ($r = 0.40$, $p < 0.001$). The results were replicated when only analysing the EMDR subsample, while in ImRs, variability was independent from change during treatment, yet remained correlated with sudden gain's magnitude (see Table 1).

Intraindividual variability was not significantly different between patients experiencing sudden gains during treatment ($M = 6.80$, $SD = 2.35$) and patients without sudden gains ($M = 6.35$, $SD = 3.13$), (F[1, 44.68] $= 0.50$, $p = 0.484$). Following Shalom et al. (2018), the pre-gain variability was computed to exclude the sudden gain itself and its possible consequences. As the average number of pre-gain sessions for subjects experiencing a sudden gain was 4.58 ($SD = 2.38$), the calculation of pre-gain variability for subjects without sudden gains was based on their first five sessions. This was done in analogy to Shalom et al. (2018) in order to equate the timing and number of observations between the two groups. The difference in intraindividual variability between sudden gainers ($M = 6.93$, $SD = 4.02$) and non-sudden gainers ($M = 6.35$, $SD = 3.13$) remained non-significant (F [1, 71.05] $= 0.25$, $p = 0.612$). When restricting variability in the non-sudden gains group to values up to session five, there was still no difference between sudden gainers ($M = 6.93$, $SD = 4.02$) and non-sudden gainers ($M = 6.73$, $SD = 3.88$); (F[1, 60.04] $= 0.01$, $p = 0.921$; see Table 2.)

When conducting the same models as two-way ANOVAs adding treatment condition as a moderator, there were significant interactions for all three models between sudden gain status and treatment condition (see Table 3). The simple main effect analysis of the model for variability along treatment showed significantly higher variability for sudden gainers than for subjects without sudden gains in the EMDR condition ($p = 0.017$), which was not the case in the ImRs condition ($p = 0.247$). This relationship was also found when considering only pre-gain variability for the sg-group, with higher variability for subjects with sudden gains in the EMDR condition ($p = 0.029$) than in the ImRs-condition ($p = 0.283$). For the model with only variability up to session five for the non-sudden gainers, this relationship was not found. All other effects in the conducted models remained non-significant (all $ps > 0.05$, see Table 3). A descriptive trend towards higher variability in the EMDR-condition (vs. ImRs) and higher variability for non-sudden gainers within the ImRs condition was found (see Table 3). Because of the non-significant results in the ImRs condition, logistic regressions of sudden gains status via pre-gain variability were only conducted for the EMDR subsample (following Shalom et al., 2018). The models with pre-gain variability for sudden gainers and the second model with variability restricted for the NSG group (up to session five) were non-significant (see Table A4).

TABLE 1 Characteristics of intraindividual variability in symptoms.

Characteristic	Sample	EMDR	ImRs
Mean (*SD*)	6.62 (2.68)	6.90 (2.84)	6.35 (2.51)
Range	1.27–13.91	1.27–13.91	2.82–13
Skewness of distribution	0.62	0.32	0.95
Kurtosis of distribution	−0.17	−0.48	0.32
Correlation with change during treatment	$r = 0.25$ ($p = 0.005$**)	$r = 0.34$ ($p = 0.007$**)	$r = 0.11$ ($p = 0.402$)
Correlation with sudden gains magnitude	$r = 0.40$ ($p = 0.000$***)	$r = 0.36$ ($p = 0.018$*)	$r = 0.35$ ($p = 0.039$*)

Note: ImRs = imagery rescripting; EMDR = eye movement desensitization and reprocessing.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

TABLE 2 Intraindividual variability in symptoms as predictor of sudden gains.

Predictor	M_{SG} (SD_{SG})	n_{SG}	M_{NSG} (SD_{NSG})	n_{NSG}	F	Df	p	Effect size ξ
Variability along course of treatment	6.80 (2.35)	78	6.35 (3.13)	49	0.50	1, 44.68	0.484	0.13
Pre-gain variability for SG	6.93 (4.02)	78	6.35 (3.13)	49	0.26	1, 71.05	0.612	0.13
Variability up to session 5 for NSG	6.93 (4.02)	78	6.73 (3.88)	48	0.01	1, 60.04	0.921	0.11

Note: SG = sudden gainers; NSG = non-sudden gainers. The assumption of normally distributed residuals was not met in these models; therefore, robust models based on trimmed means with bootstrap (20%) were calculated. The original models differed significantly; therefore, the robust models are reported. The effect size known as explanatory measure of effect size (ξ) can be interpreted like a Pearson's correlation (following Field & Wilcox, 2017).

TABLE 3 Intraindividual variability in symptoms as a predictor of sudden gains, using treatment condition as a moderator.

Predictor	M_{SG} (SD_{SG})	n_{SG}	M_{NSG} (SD_{NSG})	n_{NSG}	F	Df	p	Partial η^2
Variability along course of treatment								
sg-status					0.92	1, 123	0.339	0.007
Condition					0.2	1, 123	0.657	0.002
sg-status* condition					6.53	1, 123	0.012*	0.05
EMDR	7.46 (2.48)	42	5.77 (3.21)	21	5.84	1, 123	0.017*	
ImRs	6.02 (1.96)	36	6.79 (3.06)	28	1.35	1, 123	0.247	
Pre-gain variability for SG								
sg-status					0.75	1, 123	0.389	0.006
Condition					0.67	1, 123	0.415	0.005
sg-status* condition					5.50	1, 123	0.021*	0.04
EMDR	7.91 (4.20)	42	5.77 (3.21)	21	4.87	1, 123	0.029*	
ImRs	5.80 (3.52)	36	6.79 (3.06)	28	1.64	1, 123	0.283	
Variability up to session 5 for NSG								
sg-status					0.06	1, 122	0.802	0.001
Condition					0.6	1, 122	0.439	0.005
sg-status* condition					4.63	1, 122	0.033*	0.04
EMDR	7.91 (4.20)	42	6.18 (4.69)	21	2.75	1, 122	0.100	
ImRs	5.80 (3.52)	36	7.17 (3.12)	27	1.90	1, 122	0.171	

Note: SG = sudden gainers; NSG = non-sudden gainers. The assumption of homoskedasticity was not met in any model and in the models with pre-gain variability, and residuals were not normally distributed. Robust models were calculated (based on trimmed means with bootstrap, 20% trimmed), and the original models did not differ significantly. Therefore, the original models were kept and are reported here (following Field & Wilcox, 2017).
*$p < 0.05$.

3.4 | Emotional change as a predictor for sudden gains

The logistic regressions of pre-gain emotional change showed that each point increase in shame increased the odds for experiencing a sudden gain by a factor of 1.29 (95% CI: 1.07, 1.57; $p < 0.05$) for the whole sample and by a factor of 1.48 (95% CI: 1.1, 2.02; $p < 0.012$) for EMDR. For the whole sample, there was a marginally significant trend for guilt, showing that each point increase in guilt decreased the odds for experiencing a sudden gain by a factor of 0.86 [95% CI: 0.72, 1.01; $p = 0.07$]. Non-significant results were observed for guilt in the subsamples and for disgust in all analyses (see Table 4).

Visual observation of self-reported guilt, shame and disgust suggested faster decreases of scores in the sudden gains group and scores remaining lower after treatment (see Figures B3 and B4). The linear mixed models with contrasts for the time steps around sudden gains showed significant group differences (sg vs. non-sg-group) for all emotions during the gain (*N to* $N + 1$), with shame also showing significant differences prior to the gain ($N - 1$ to N; all *ps* < 0.05). Within the sg-group, there were significant decreases for all emotions in the sessions prior to the gain and for disgust and shame following the gain ($N + 1$ to $N + 2$; all *ps* < 0.05). Descriptively, the decreases were larger than in the non-sg-group. Apart from shame (only pre-pre-gain; $N - 2$ *to* $N - 1$), all changes within the non-sudden-gainers group were not significant (all *ps* > 0.05; see Table 5). When analysing ImRs and EMDR separately, significant group differences were observed for both treatments for shame prior to and during the gain. Group differences at the post-gain session were only significant for guilt in EMDR, changes of disgust only in the ImRs condition. In both subsamples, apart from shame (only pre-pre-gain; $N - 2$ to $N - 1$) all changes within the non-sudden-gainers group were not significant (all *ps* > 0.05). Within the sg-group in the EMDR condition, significant decreases of all emotions prior to the gain and reductions of shame and disgust post-gain occurred (all *ps* > 0.05; see Table A5). Within the sg-group in ImRs, there were significant changes for all emotions during the gain, for guilt and disgust pre-pre gain and for disgust post-gain.

4 | DISCUSSION

We investigated the predictive value of intraindividual variability and emotional change around sudden gains. Half of the participants reported at least one gain and treatment outcomes at post-treatment, and both follow-up assessments were significantly better for patients with sudden gains than for non-sudden gainers. Intraindividual variability did not predict the occurrence of sudden gains and was not independent of the treatment effect. For subjects with sudden gains, decreases of guilt, shame and disgust during sudden gains were significantly greater than for non-sudden gainers. In both treatments, changes in emotions and reductions in PTSD symptoms were more pronounced within the sudden gains group. In line with previous work

TABLE 4 Logistic regression analyses predicting the occurrence of sudden gains through emotions during treatment.

	Sample		EMDR		ImRs	
Term	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***
Guilt	0.86 (0.72 to 1.01)	0.07	0.88 (0.68 to 1.12)	0.3	0.86 (0.67 to 1.09)	0.209
Shame	1.29 (1.07 to 1.57)	0.009**	1.48 (1.1 to 2.02)	0.012*	1.16 (0.9 to 1.52)	0.251
Disgust	0.96 (0.82 to 1.11)	0.55	0.89 (0.69 to 1.13)	0.33	0.99 (0.82 to 1.2)	0.913

Note: Sudden gains (0 = no, 1 = yes). OR = odds ratio.
$^*p < 0.05$. $^{**}p < 0.01$.

TABLE 5 Estimated changes in guilt, shame and disgust for all patients during the time intervals around the sudden gain.

	SG		NSG		Group difference	
Emotion/time interval	$\delta_1(SE)$	p	$\delta_2(SE)$	p	$\Delta_3(SE)$	p
Guilt						
$N-2$ to $N-1$	−0.26 (0.12)	0.032*	−0.19 (0.14)	0.180	−0.08 (0.19)	0.675
$N-1$ to N	−0.38 (0.11)	0.001**	−0.07 (0.14)	0.639	−0.32 (0.18)	0.077
N to $N+1$	−0.53 (0.11)	0.000***	−0.11 (0.14)	0.415	−0.41 (0.18)	0.022*
$N+1$ to $N+2$	−0.14 (0.11)	0.206	0.06 (0.14)	0.664	−0.20 (0.18)	0.261
Shame						
$N-2$ to $N-1$	−0.12 (0.13)	0.331	−0.45 (0.14)	0.002**	0.32 (0.19)	0.088
$N-1$ to N	−0.49 (0.11)	0.000***	0.23 (0.14)	0.107	−0.72 (0.18)	0.000***
N to $N+1$	−0.71 (0.11)	0.000***	−0.08 (0.14)	0.552	−0.62 (0.18)	0.001**
$N+1$ to $N+2$	−0.23 (0.11)	0.043*	−0.08 (0.14)	0.570	−0.15 (0.18)	0.416
Disgust						
$N-2$ to $N-1$	−0.29 (0.14)	0.034*	−0.20 (0.15)	0.188	−0.09 (0.20)	0.671
$N-1$ to N	−0.26 (0.12)	0.035*	0.03 (0.15)	0.848	−0.29 (0.20)	0.143
N to $N+1$	−0.53 (0.12)	0.000***	−0.05 (0.15)	0.728	−0.47 (0.20)	0.016*
$N+1$ to $N+2$	−0.45 (0.12)	0.000***	−0.10 (0.15)	0.506	−0.35 (0.20)	0.077

Note: SG = sudden gainers; NSG = non-sudden gainers. To compare the two groups, *N* in the NSG group was set to 5, as the number of pre-gain sessions in the SG group was $M = 4.58$ ($SD = 2.38$). *SE* = standard error. For each time interval, the estimated changes were compared within (δ_1 and δ_2) and between (Δ_3) groups.
$^*p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

(Aderka et al., 2012; Shalom & Aderka, 2020), no baseline characteristics or scores predicted sudden gains.

Importantly, the temporal occurrence of sudden gains corresponded with the specific treatment protocols. In EMDR, a higher frequency of sudden gains was observed at the beginning of the treatment, corresponding to the start of active trauma processing from session two onwards. In ImRs, the additional peak between sessions seven and nine marks an important change in the treatment protocol, as starting from session seven, patients take on an active role by rescripting from their present adult perspective, whereas the therapists had previously rescripted in the sessions. Furthermore, in ImRs, differences between sudden gainers and non-sudden gainers were more pronounced at post-treatment and all follow-ups than in EMDR patients. This could mean that once patients experience a sudden gain, processes in ImRs are more effective at eliciting an upward spiral of symptom improvement. Our study was not designed to address reasons for the temporal occurrence of sudden gains in EMDR and ImRs. Accordingly, future research in this respect is warranted.

Intraindividual variability was significantly correlated with symptom change during treatment and with the magnitude of sudden gains in the whole sample. In the EMDR condition, subjects with sudden gains had a higher variability than non-sudden gainers along treatment and when restricting variability for sudden gainers only to pre-gain variability. However, in the logistic regressions for sudden gain status in the EMDR condition, only variability along treatment yielded a marginally significant result. Importantly, in EMDR, intraindividual variability was significantly correlated with change during treatment and with the magnitude of sudden gains, thus not independent of these aspects. In ImRs, variability was only correlated with sudden gains magnitude and not with change during treatment. The subjects in ImRs with and without sudden gains did not differ with respect to variability, and no prediction of sg-status by variability was found. This pattern of results is contrary to the findings by Shalom et al. (2018), who found an independence of intraindividual variability from change during treatment and from sudden gains magnitude. They found variability to be a significant predictor for group differences between sudden gainers and non-sudden gainers, and that prediction of sudden gain status was possible even when excluding pre-gain variability, meaning the exclusion of the sudden gain itself.

Differences in treatments, sample-characteristics or study design may explain our deviating results. Previous analyses have been conducted with datasets derived from prolonged exposure (for PTSD), CBT (for obsessive compulsive disorder and social anxiety disorder) and psychodynamic therapy (for diverse disorders; see Shalom et al., 2018, 2020). Within our study, EMDR and ImRs differed with respect to the link of variability with change during treatment and the differences of sudden gainers and non-sudden gainers following treatment. Furthermore, variability seems to be higher in EMDR in general and within ImRs higher for non-sudden gainers.

The lack of a significant correlation of change during treatment with variability and the failure of sudden gain prediction in the ImRs condition could be due to ImRs eliciting more gradual changes than EMDR. This suggests that the process of change here is rather continuous, which could be inherent in the procedure of ImRs: Starting with the first rescript, the old memory is activated, but then the treatment centres on changing the course of events so that patients feel comforted and safe. This could result in milder changes and less variability during treatment, also affecting the link with sudden gains. Evidence for faster changes in EMDR (vs. ImRs) was also found in the original IREM study (Boterhoven de Haan et al., 2020) in some assessments during treatment.

Finally, the fact that variability within ImRs seems to be higher for non-sudden gainers than for sudden gainers also contradicts the assumptions of Shalom et al. (2018): If there was a strong connection of variability and sudden gains, one would rather expect a lower variability in subjects with no sudden gains. In line with this observation, König et al. (2014) found that sudden gainers did not fluctuate more than non-gainers. Another difference to Shalom et al. (2018) lies in our sample characteristics. Our sample of adult patients with childhood trauma had a longer lasting course of psychopathology. Accordingly, symptom fluctuation or treatment response in this population might involve other mechanisms of change, which might explain the missing link of variability with sudden gains.

Another explanation may lie in different sample sizes, as our results are based on a larger sample than in any of the previous studies, resulting in a higher power. In this regard, it is noteworthy that the 'dataset 1' in Shalom et al. (2018), being most similar to ours (more controlled design, patients with PTSD, RCT-data), showed a similarly high sg-frequency (around 50%) and yielded a marginally significant correlation ($p = 0.07$) of change during treatment with intraindividual variability. This may suggest that this link was not found in the other samples because of a less controlled data structure with less power. Finally, our data were collected twice per week (vs. weekly or longer intervals in previous studies). This may also affect or moderate the relationship of variability and sudden gains and should be investigated in further studies. In a nutshell, the revised theory of Aderka and Shalom (2021) seems to be a fruitful framework for understanding the nature of sudden gains. Yet its foundations have to be investigated further before drawing firmer conclusions.

Overall, we found evidence for changes in guilt, shame and disgust before, during and after sudden gains. Importantly, shame seems to differ from the other emotions: it decreased shortly before a gain in both treatments and in EMDR predicted sudden gains. Hence, reductions in shame in EMDR can be considered as precursors for sudden gains. Maybe this is due to the interpersonal character of this emotion in interaction with EMDR. The special role of shame is in line with previous studies, which showed that levels of shame need to decrease before improvements in PTSD symptoms occur (Øktedalen et al., 2015; Puhalla et al., 2021; Shi et al., 2021) and with findings that shame in connection with PTSD leads to negative psychological outcomes (O'Donohue & Schewe, 2019).

Guilt and disgust did not predict sudden gains, and changes shortly before a gain were non-significant. Yet, all emotions showed stronger decreases during sudden gains in subjects with sudden gains (vs. non-sudden gainers). Within the sudden gains group, there were reductions prior to and during a gain in both treatments for all emotions. This hints at an involvement of the emotions in the change process. However, it remains unclear which exact mechanism facilitates the occurrence of sudden gains in connection with shame in the EMDR condition, which needs to be investigated in future research.

In sum, these findings show that guilt, shame and disgust might be involved in the occurrence of sudden gains, or in sustainment of gains and/or in facilitating further improvement during treatment. Together with the temporal pattern and newer findings (see Lemmens et al., 2021; O'Mahen et al., 2021), this contradicts the assumption of sudden gains being merely a form of random fluctuations and suggests that they mark important and meaningful points in the change process.

Our study has several limitations. First, we measured emotions via single items. As found for guilt in PTSD, the type of measure can have a moderating effect on the relationship between the emotion and PTSD symptoms (Kip et al., 2022). However, single item scales can also show good psychometric properties (e.g. found for measuring happiness; see Abdel-Khalek, 2006). Furthermore, different criteria to define sudden gains have been suggested, and our criteria were based on the recommendations by Tang and DeRubeis (1999). Applying different criteria changes the amount of sudden gains (Vittengl et al., 2015) and may ultimately lead to examining different psychological constructs (Shalom & Aderka, 2020). Another limitation is the use of the IES-R (Weiss, 2007), as it does not include the cluster of negative alterations in cognitions and mood PTSD symptoms, which was added to the diagnosis in the latest version of DSM-5 (American Psychiatric Association, 2013).

Additionally, the widely used approach of using sudden gains to predict treatment outcome can be criticized for its risk of autocorrelation (see also, Lemmens & DeRubeis, 2017). Results may also in principle be influenced by a concentration of non-responders in the non-gain group, resulting in a lower overall improvement in this group with effects on the investigated relationship. However, some researchers also found the effects of sudden gain status within the group of responders (see Tang et al., 2007; Tang & DeRubeis, 1999). Furthermore, variability in this study and in the former by Shalom et al. (2018) is investigated in connection with sudden gains, which are themselves a form of variability.

Strengths of the present study are a replication of the measure of intraindividual variability with a controlled and standardized dataset outside the original research group of Shalom et al. (2018, 2020) and the comparison of two treatments within one project. We provided a detailed assessment of session-based data, with the high temporal resolution of measurements twice per week. Furthermore, to our knowledge, the work at hand is the first published study examining emotional change around sudden gains.

The current findings have several clinical implications. They provide evidence that emotional changes during PTSD treatment are highly relevant and should be considered and monitored during treatment. Furthermore, therapists should expect sudden shifts in psychopathology at important points of treatment protocols. Finally, the timing of sudden gains with respect to the treatment protocols highlights the importance of this phenomenon and its possible connection to effective mechanisms of change in clinical practice.

Future research should investigate intraindividual variability and its connection to sudden gains in different treatments and populations, and examine whether intraindividual variability is orthogonal to change during treatment. The current results do not support intraindividual variability to serve as a theoretical foundation for revised theories on sudden gains. Also, the effect of the length of measurement intervals needs to be addressed in future research. Furthermore, more studies should investigate patterns of emotional change in treatments of PTSD, including non-fear emotions.

In sum, our results show that intraindividual variability was not predictive for the occurrence of sudden gains across EMDR and ImRs in PTSD. Recent findings by Shalom et al. (2018) do not easily generalize across treatments, disorders and populations. The changes of guilt, shame and disgust found around sudden gains highlight their role in the change process, and these findings may foster future research.

ACKNOWLEDGEMENTS

Open Access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The Dutch law, building on the European Data protection guideline, does not allow data sharing without permission; therefore, access to the original data cannot be granted.

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How to cite this article: Kuck, S., Arntz, A., Rameckers, S. A., Lee, C. W., Boterhoven de Haan, K. L., Fassbinder, E., & Morina, N. (2023). Intraindividual variability and emotional change as predictors of sudden gains in imagery rescripting and EMDR for PTSD in adult survivors of childhood abuse. *Clinical Psychology & Psychotherapy*, *30*(5), 1029–1046. https://doi.org/10.1002/cpp.2855

APPENDIX A

TABLE A1 Demographic and clinical characteristics of the sample.

Characteristic	Treatment condition, *n* (%) of patients[a] All ($N = 155$)	ImRs ($n = 74$)	EMDR ($n = 81$)
Age in years, mean (*SD*)	38.54 (11.17)	38.08 (10.85)	38.96 (11.51)
Gender			
Male	36 (23.2)	20 (27.0)	16 (19.8)
Female	119 (76.8)	54 (73.0)	65 (80.2)
Relationship status			
Partner	96 (61.9)	48 (64.9)	48 (59.3)
No partner	59 (38.1)	26 (35.1)	33 (40.7)
Education level			
No/primary education	8 (5.2)	6 (8.1)	2 (2.5)
Secondary education	45 (29.0)	18 (24.3)	27 (33.3)
Tertiary/vocational education	88 (56.8)	42 (56.8)	46 (56.8)
University bachelor/masters	14 (9.1)	8 (10.8)	6 (7.4)
Work status			
Working	63 (40.7)	29 (39.2)	34 (42.0)
Not working	21 (13.5)	10 (13.6)	11 (13.5)
Disability pension	54 (34.8)	28 (37.9)	26 (32.0)
Unemployed	17 (11.0)	7 (9.5)	10 (12.3)
Index traumas			
Sexual abuse/assault	91 (58.7)	36 (48.6)	55 (67.9)
Physical abuse	31 (20.0)	15 (20.3)	16 (19.8)
Mixed abuse	8 (5.2)	6 (8.1)	2 (2.5)
Domestic violence	14 (9.0)	9 (12.2)	5 (6.2)
Serious injury/death	6 (3.9)	4 (5.4)	2 (2.5)
Other	5 (3.2)	4 (5.5)	1 (1.2)
Index trauma duration in years, mean (*SD*)	7.22 (4.92)	7.59 (5.20)	6.79 (4.60)
Index trauma onset in years, mean (*SD*)	7.95 (4.17)	7.77 (4.21)	8.12 (4.16)
PTSD duration in months, mean (*SD*)	215.26 (175.08)	212.18 (176.71)	218.07 (174.63)
Comorbid disorders			
Mood disorders	111 (71.6)	54 (73.0)	57 (70.4)
Anxiety disorders	87 (56.1)	38 (51.4)	49 (60.5)
Other	39 (25.2)	16 (21.6)	23 (28.4)
Previous treatment	126 (81.3)	62 (83.8)	64 (79.0)
Previous psychiatric admission	39 (25.2)	16 (21.6)	23 (28.4)
Current medication	71 (45.8)	30 (40.5)	41 (50.6)
Alcohol or substance use	84 (54.2)	36 (48.6)	48 (59.3)

Note: ImRs = imagery rescripting; EMDR = eye movement desensitization and reprocessing; PTSD = post-traumatic stress disorder.
[a]Percentages have been rounded and may not total 100.

TABLE A2 Logistic regression analyses predicting sudden gains with treatment condition as moderator.

Predictors	OR (95% CI)	*p*
Demographic characteristics		
Age	0.99 (0.95 to 1.04)	0.782
Age*treatment condition	0.97 (0.91 to 1.03)	0.342
Sex	1.26 (0.29 to 4.98)	0.740
Sex*treatment condition	1.13 (0.19 to 6.89)	0.896
Baseline psychopathology		
Months since trauma	1.00 (1.00 to 1.00)	0.625
Months since trauma*treatment condition	1.00 (1.00 to 1.00)	0.610
PTSD symptoms (IES-R)	1.01 (0.97 to 1.04)	0.761
PTSD symptoms (IES-R) *treatment condition	0.98 (0.93 to 1.03)	0.421
Comorbid anxiety	0.80 (0.28 to 2.27)	0.672
Comorbid anxiety*treatment condition	2.08 (0.50 to 8.82)	0.316
Comorbid depression	1.28 (0.45 to 3.78)	0.652
Comorbid depression*treatment condition	0.80 (0.18 to 3.48)	0.764
Baseline emotions		
Guilt	0.94 (0.65 to 1.35)	0.727
Guilt*treatment condition	0.96 (0.58 to 1.60)	0.887
Shame	1.19 (0.86 to 1.67)	0.301
Shame*treatment condition	0.72 (0.43 to 1.19)	0.204
Disgust	1.09 (0.75 to 1.59)	0.651
Disgust*treatment condition	1.07 (0.64 to 1.81)	0.784

Note: A logistic regression model was calculated for each variable, in which treatment condition was added as moderator. Sudden gains (0 = no, 1 = yes). Sex (1 = male, 2 = female). Treatment condition (1 = EMDR, 2 = ImRs). ImRs = imagery rescripting; EMDR = eye movement desensitization and reprocessing; PTSD = post-traumatic stress disorder; IES-R = Impact of Events Scale – Revised.

TABLE A3 Treatment outcome for patients with and without sudden gains.

	Unadjusted mean (*SD*)				Adjusted difference at post-treatment and follow-up▲		
Group/time	M_{SG}	n_{SG}	M_{NSG}	n_{NSG}	Mean [95% CI]	*d* [95% CI]	*p*
Sample							
Pre	48.80 (14.23)	78	50.02 (17.10)	51			
Post	11.33 (10.39)	76	30.85 (23.47)	47	−19.84 [−26.84, −12.84]	1.30 [0.80, 1.69]	0.000***
FU1	12.36 (13.97)	70	27.66 (24.73)	44	−16.47 [−23.60, −9.33]	1.08 [0.67, 1.48]	0.000***
FU2	13.30 (16.88)	57	22.17 (21.13)	41	−12.80 [−20.16, −5.44]	0.84 [0.42, 1.25]	0.000***
EMDR							
Pre	48.79 (14.30)	42	47.55 (18.21)	23			
Post	11.27 (11.46)	41	25.82 (24.76)	22	−14.98 [−25.23, −4.73]	0.96 [0.42, 1.51]	0.001**
FU1	13.87 (16.20)	39	23.10 (22.89)	21	−10.54 [−20.90, −0.17]	0.68 [0.13, 1.22]	0.020*
FU2	13.73 (17.86)	33	19.70 (21.68)	20	−10.78 [−21.36, −0.21]	0.69 [0.12, 1.26]	0.019*
ImRs							
Pre	48.83 (14.35)	36	52.04 (16.20)	28			
Post	11.40 (9.15)	35	35.28 (21.82)	25	−23.60 [−32.92, −14.28]	1.57 [0.98, 2.15]	0.000***
FU1	10.45 (10.49)	31	31.83 (26.10)	23	−22.28 [−31.89, −12.67]	1.48 [0.86, 2.08]	0.000***
FU2	12.71 (15.80)	24	24.52 (20.83)	21	−14.61 [−24.66, −4.56]	0.97 [0.35, 1.59]	0.001**

Note: Treatment outcome in PTSD symptoms was measured with the IES-R. SG = sudden gainers; NSG = non-sudden gainers. Pre = baseline; Post = post-treatment; FU1 = follow-up 1; FU2 = follow-up 2; ImRs = imagery rescripting; EMDR = eye movement desensitization and reprocessing; PTSD = post-traumatic stress disorder. *d* = between-group standardized effect size. ▲The difference is adjusted for baseline scores.
$^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

TABLE A4 Logistic regression analyses for the EMDR subsample predicting sudden gains through pre-gain intraindividual variability in symptoms.

Predictors	OR (95% CI)	*p*
EMDR		
Pre-gain variability for SG	1.17 (1.01 to 1.38)	0.051
Variability up to session 5 for NSG	1.10 (0.97 to 1.26)	0.146

Note: SG = sudden gainers; NSG = non-sudden gainers; EMDR = eye movement desensitization and reprocessing. Sudden gains (0 = no, 1 = yes).

TABLE A5 Estimated changes in guilt, shame and disgust for all patients during the time intervals around the sudden gain.

	SG		NSG		Group difference	
Treatment condition: emotion/time interval	$\delta_1(SE)$	*p*	$\delta_2(SE)$	*p*	$\Delta_3(SE)$	*p*
EMDR: Guilt						
$N-2$ to $N-1$	0.06 (0.17)	0.711	−0.06 (0.21)	0.755	0.13 (0.27)	0.634
$N-1$ to N	−0.47 (0.15)	0.002**	−0.24 (0.21)	0.250	−0.23 (0.26)	0.366
N to $N+1$	−0.50 (0.15)	0.001**	0.09 (0.21)	0.661	−0.59 (0.26)	0.021*
$N+1$ to $N+2$	−0.12 (0.15)	0.428	−0.05 (0.21)	0.827	−0.07 (0.26)	0.774
ImRs: Guilt						
$N-2$ to $N-1$	−0.62 (0.18)	0.001**	−0.29 (0.19)	0.123	−0.33 (0.26)	0.194
$N-1$ to N	−0.28 (0.16)	0.089	0.07 (0.19)	0.700	−0.35 (0.25)	0.158
N to $N+1$	−0.56 (0.16)	0.001**	−0.28 (0.19)	0.138	−0.28 (0.25)	0.265
$N+1$ to $N+2$	−0.17 (0.16)	0.308	0.15 (0.19)	0.432	−0.31 (0.25)	0.207
EMDR: Shame						
$N-2$ to $N-$	0.04 (0.18)	0.839	−0.52 (0.22)	0.016*	0.56 (0.28)	0.046*
$N-$ to N	−0.64 (0.16)	0.000***	0.26 (0.22)	0.247	−0.90 (0.27)	0.001**
N to $N+1$	−0.71 (0.16)	0.000***	−0.05 (0.22)	0.833	−0.67 (0.27)	0.012*
$N+1$ to $N+2$	−0.31 (0.16)	0.048*	−0.14 (0.22)	0.528	−0.17 (0.27)	0.516
ImRs: Shame						
$N-2$ to $N-1$	−0.31 (0.18)	0.087	−0.39 (0.19)	0.035*	0.09 (0.26)	0.741
$N-1$ to N	−0.31 (0.16)	0.063	0.21 (0.19)	0.249	−0.52 (0.25)	0.036*
N to $N+1$	−0.69 (0.16)	0.000***	−0.12 (0.19)	0.538	−0.58 (0.25)	0.021*
$N+1$ to $N+2$	−0.14 (0.16)	0.397	−0.04 (0.19)	0.845	−0.10 (0.25)	0.684
EMDR: Disgust						
$N-2$ to $N-$	−0.23 (0.20)	0.254	−0.22 (0.24)	0.359	−0.01 (0.31)	0.987
$N-1$ to N	−0.48 (0.18)	0.007**	−0.03 (0.25)	0.903	−0.45 (0.30)	0.141
N to $N+1$	−0.55 (0.18)	0.002**	−0.09 (0.24)	0.710	−0.46 (0.30)	0.130
$N+1$ to $N+2$	−0.55 (0.18)	0.002**	−0.27 (0.24)	0.265	−0.27 (0.30)	0.363
ImRs: Disgust						
$N-2$ to $N-1$	−0.37 (0.18)	0.036*	−0.18 (0.18)	0.326	−0.19 (0.25)	0.455
$N-1$ to N	0.00 (0.16)	1.00	0.07 (0.18)	0.694	−0.07 (0.24)	0.768
N to $N+1$	−0.50 (0.16)	0.002**	−0.02 (0.18)	0.919	−0.48 (0.24)	0.049*
$N+1$ to $N+2$	−0.33 (0.16)	0.038*	0.04 (0.19)	0.841	−0.37 (0.24)	0.130

Note: SG = sudden gainers; NSG = non-sudden-gainers. To compare the two groups, *N* in the NSG-group was set to 5, as the number of pre-gain sessions in the SG group was $M = 4.58$ ($SD = 2.38$). *SE* = standard error. For each time interval, the estimated changes were compared within (δ_1 and δ_2) and between (Δ_3) groups.
*$p < 0.05$.**$p < 0.01$.***$p < 0.001$.

APPENDIX B

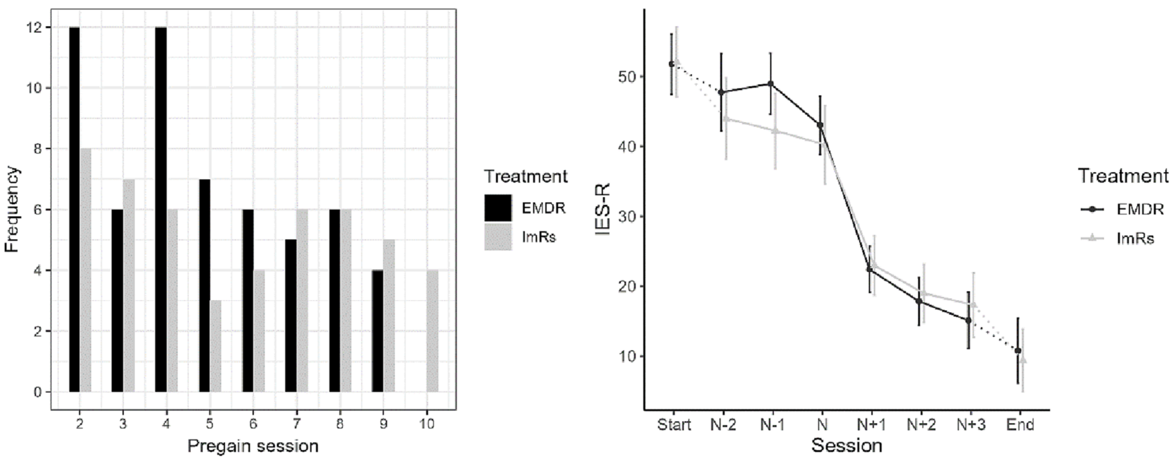

FIGURE B1 a Frequency distribution of pre-gain sessions for sudden gains, according to treatment condition. Frequencies are based on the number of patients who experienced sudden gains in each group, respectively (EMDR: $n = 42$; ImRs: $n = 36$). b. Average change of sum scores of the impact of event scale revised around sudden gains for patients being treated with EMDR and ImRs. Error bars indicate 95% confidence intervals.

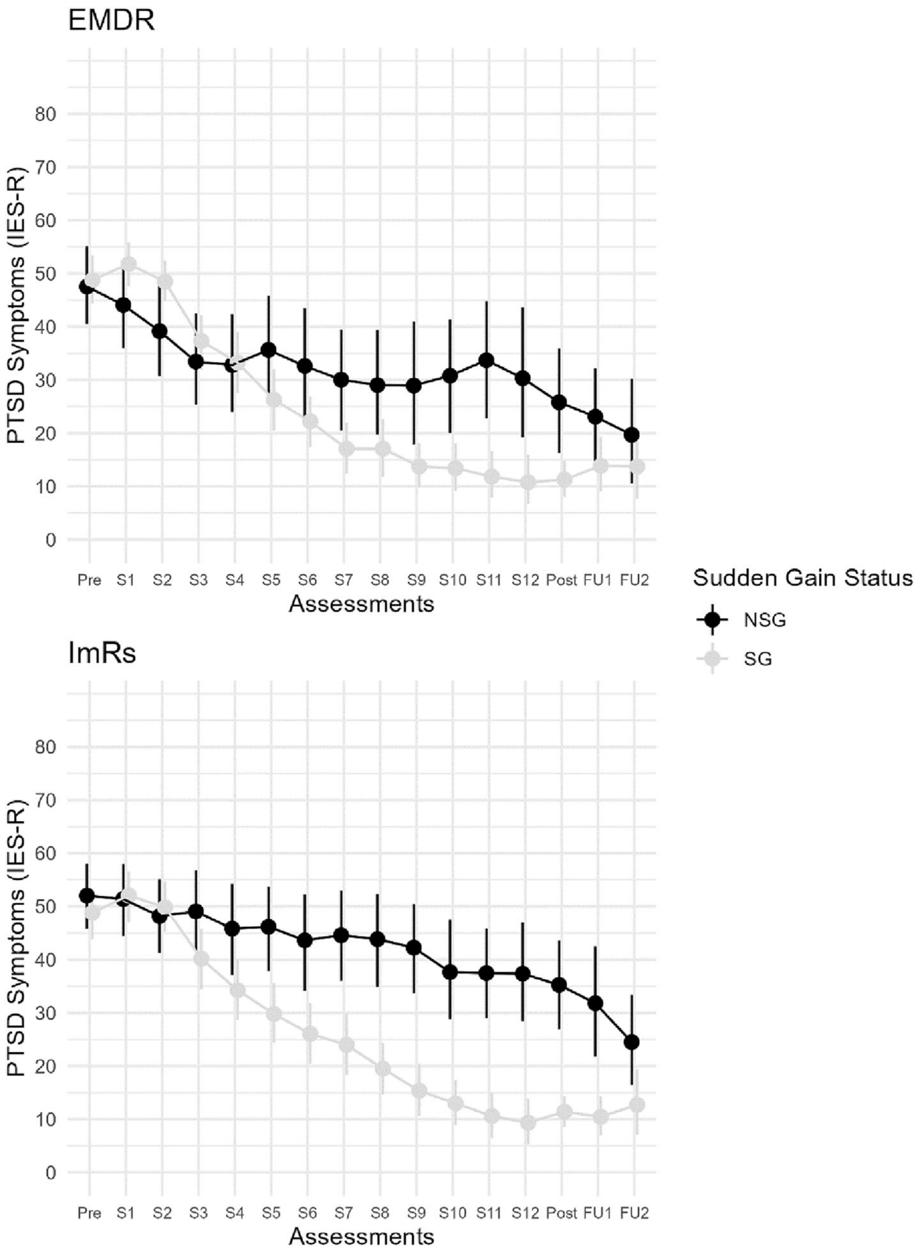

FIGURE B2 Average PTSD symptoms (measured with the IES-R) from pre-treatment up to a follow-up 12 months after pre-treatment, according to sudden gains status. SG = sudden gainers, NSG = non-sudden gainers.

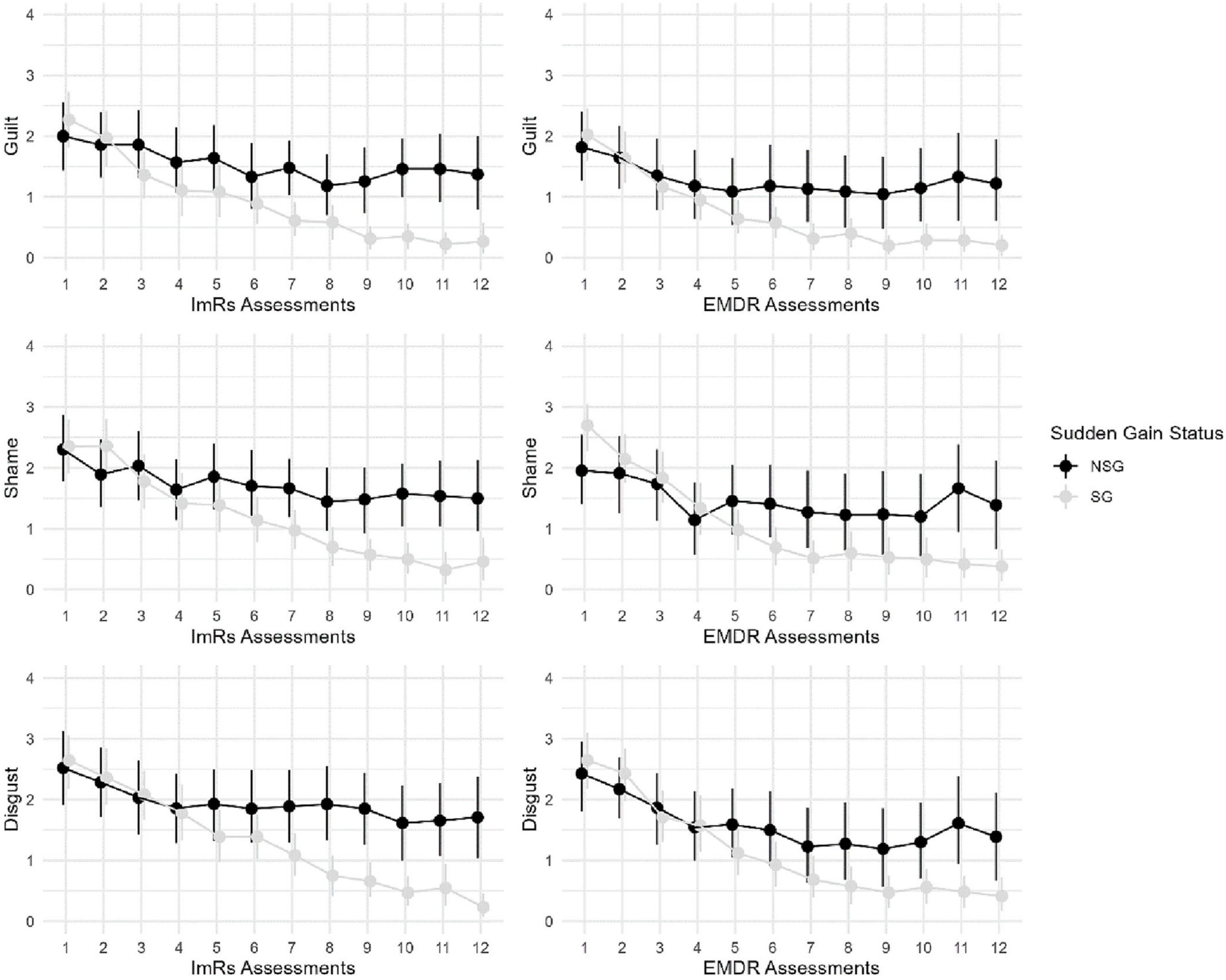

FIGURE B3 Average emotions levels (guilt, shame and disgust) from session 1 to session 12 during treatment, according to sudden gains status separated for EMDR and ImRs treatments. SG = sudden gainers, NSG = non-sudden gainers.

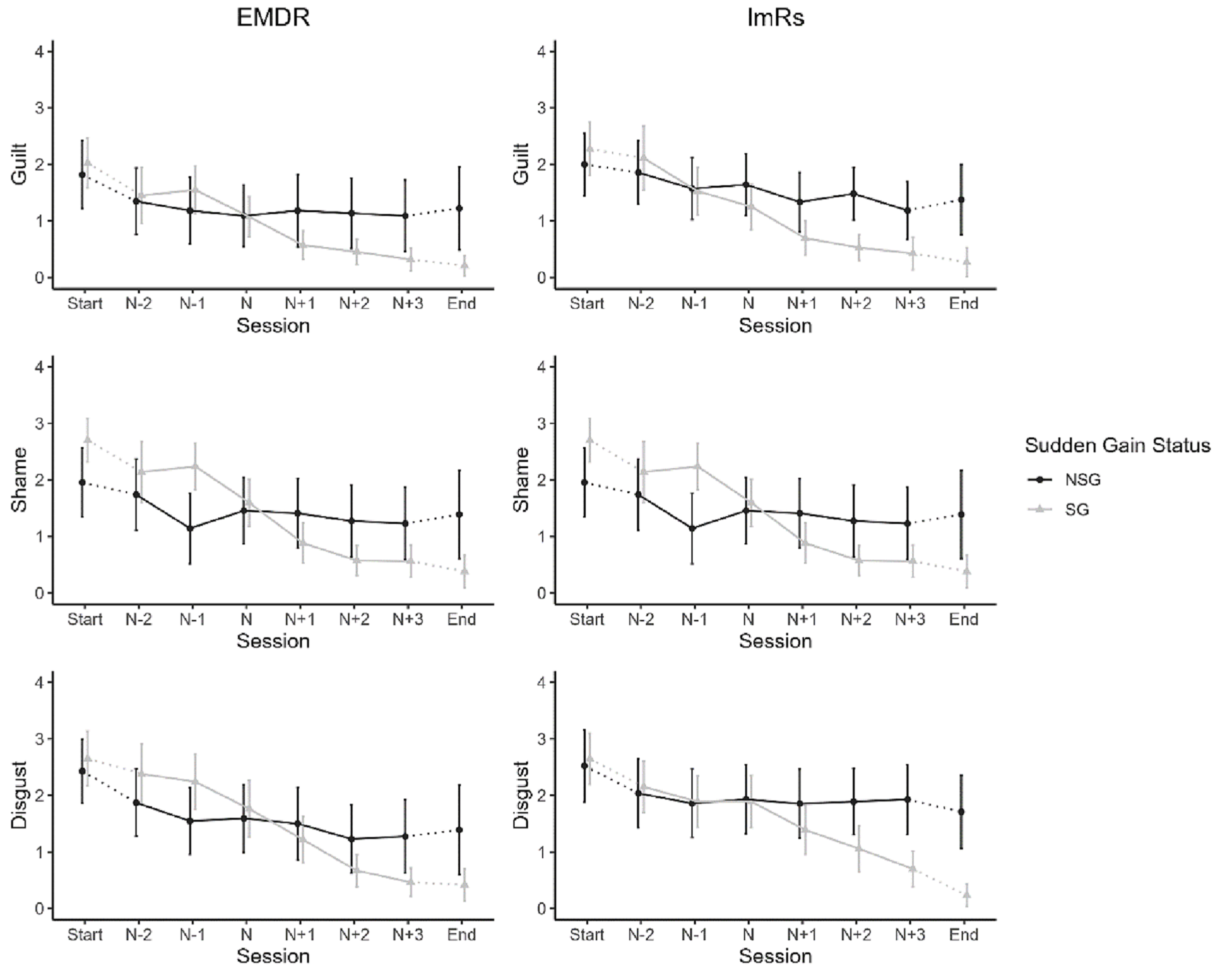

FIGURE B4 Average sum scores of guilt, shame and disgust around sudden gains according to sudden gain status separated for EMDR and ImRs-treatments. SG = sudden gainers, NSG = non-sudden gainers. To compare the two groups, N in the NSG group was set to 5, as the number of pre-gain sessions in the SG group was $M = 4.58$ ($SD = 2.38$).