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Comparison of eye movement desensitization and reprocessing therapy, cognitive behavioral writing therapy, and wait-list in pediatric posttraumatic stress disorder following single-incident trauma: a multicenter randomized clinical trial

Carlijn de Roos,[1] Saskia van der Oord,[2,3] Bonne Zijlstra,[4] Sacha Lucassen,[5] Sean Perrin,[6] Paul Emmelkamp,[7,8] and Ad de Jongh[9,10]

[1]MHO Rivierduinen, Leiden, The Netherlands; [2]Research Group Clinical Psychology, Department of Psychology and Educational Sciences, KU Leuven, Leuven, Belgium; [3]Department of Developmental Psychology, University of Amsterdam (UVA), Amsterdam, The Netherlands; [4]Department of Child Development and Education, University of Amsterdam (UVA), Amsterdam, The Netherlands; [5]UvA minds, Amsterdam, The Netherlands; [6]Department of Psychology, Lund University, Lund, Sweden; [7]Netherlands Institute for Advanced Study, Amsterdam, The Netherlands; [8]Department of Clinical Psychology, University of Amsterdam, Amsterdam, The Netherlands; [9]Department of Social Dentistry and Behavioral Sciences, Academic Centre for Dentistry Amsterdam (ACTA), University of Amsterdam, Amsterdam, The Netherlands; [10]Institute of Health and Society, University of Worcester, Worcester, UK

Background: Practice guidelines for childhood posttraumatic stress disorder (PTSD) recommend trauma-focused psychotherapies, mainly cognitive behavioral therapy (CBT). Eye movement desensitization and reprocessing (EMDR) therapy is a brief trauma-focused, evidence-based treatment for PTSD in adults, but with few well-designed trials involving children and adolescents. **Methods:** We conducted a single-blind, randomized trial with three arms (n = 103): EMDR (n = 43), Cognitive Behavior Writing Therapy (CBWT; n = 42), and wait-list (WL; n = 18). WL participants were randomly reallocated to CBWT or EMDR after 6 weeks; follow-ups were conducted at 3 and 12 months posttreatment. Participants were treatment-seeking youth (aged 8–18 years) with a DSM-IV diagnosis of PTSD (or subthreshold PTSD) tied to a single trauma, who received up to six sessions of EMDR or CBWT lasting maximally 45 min each. **Results:** Both treatments were well-tolerated and relative to WL yielded large, intent-to-treat effect sizes for the primary outcomes at posttreatment: PTSD symptoms (EMDR: d = 1.27; CBWT: d = 1.24). At posttreatment 92.5% of EMDR, and 90.2% of CBWT no longer met the diagnostic criteria for PTSD. All gains were maintained at follow-up. Compared to WL, small to large (range d = 0.39–1.03) intent-to-treat effect sizes were obtained at posttreatment for negative trauma-related appraisals, anxiety, depression, and behavior problems with these gains being maintained at follow-up. Gains were attained with significantly less therapist contact time for EMDR than CBWT (mean = 4.1 sessions/140 min vs. 5.4 sessions/227 min). **Conclusions:** EMDR and CBWT are brief, trauma-focused treatments that yielded equally large remission rates for PTSD and reductions in the severity of PTSD and comorbid difficulties in children and adolescents seeking treatment for PTSD tied to a single event. Further trials of both treatments with PTSD tied to multiple traumas are warranted. **Keywords:** Posttraumatic stress disorder; eye movement desensitization and reprocessing; cognitive behavioral writing therapy; single trauma; children and adolescents.

Introduction

Meta-analyses indicate that approximately 16% of traumatically exposed youth develop posttraumatic stress disorder (PTSD; Alisic et al., 2014). Untreated, childhood PTSD is associated with significant psychiatric comorbidity, functional impairment at the child and family level and persistence into adulthood (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). To reduce the acute and long-term effects of trauma and PTSD, early and effective treatment is needed.

Practice guidelines for childhood PTSD (AACAP, 2010; NICE, 2005; WHO, 2013) recommend trauma-focused psychological therapies as the first-line approach, primarily trauma-focused cognitive behavioral therapies (TF-CBT), involving some combination of coping skills training, cognitive restructuring, therapist- and client-led exposure (imaginal and in vivo) and parent interventions, as these have the largest evidence base. Eye movement desensitization and reprocessing (EMDR) therapy is a brief, trauma-focused treatment for PTSD. The core feature of EMDR is that the patient holds a disturbing image from the trauma memory in mind while engaging in sets of saccadic eye movements (Shapiro, 2001). This method is recommended for use with adults (NICE, 2005; World Health Organisation, 2013), but with a more limited evidence base in youth. To date, there have been six randomized controlled comparison trials (RCTs) of EMDR with trauma exposed youth (aged 4–18 years), three of which used trauma-focused CBT as the active control group (De Roos

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et al., 2011; Diehle, Opmeer, Boer, Mannarino, & Lindauer, 2014; Jaberghaderi, Greenwald, Rubin, Zand, & Dolatabadi, 2004). The results suggest that both treatments are equally effective in reducing child- and parent-reported symptoms of PTSD and comorbid difficulties. However, sample sizes were relatively small (n = 14–52) and the studies lacked no-treatment controls to correct for natural recovery. Also, Jaberghaderi et al. (2004) did not use blind assessors or independent fidelity checks; only one trial used diagnostic interviews (Diehle et al., 2014); and the longest follow-up was only three months (De Roos et al., 2011). Given the overall quality of the evidence for EMDR in youth was low, further comparative trials are needed (Gillies et al., 2016; Morina, Koerssen, & Pollet, 2016).

Consistent with previous RCTs, we chose a form of trauma-focused CBT as a comparison treatment, Cognitive Behavioral Writing Therapy (CBWT; Van der Oord, Lucassen, Van Emmerik, & Emmelkamp, 2010), a brief, child-friendly version of the adult, Internet-based writing therapy for PTSD (INTERAPY; Lange et al., 2003). CBWT involves exposure to the trauma memory and restructuring of trauma-related beliefs through writing and updating of the trauma memory on a computer with the support of a therapist. In a pilot study of 23 youth (aged 8–18 years) seeking treatment for PTSD, an average of 5.5 sessions of CBWT yielded large, within-group effect sizes for PTSD, trauma-related beliefs, depression, and behavior problems (Van der Oord et al., 2010). The choice of CBWT was guided by two factors: (a) at the time that this study began, manualized versions of trauma-focused CBT including TF-CBT (Cohen, Mannarino, & Deblinger, 2006) were not widely available in the Netherlands (cf., Diehle et al., 2014); and (b) like EMDR, CBWT can be brief because it focuses entirely on exposure and reprocessing of the trauma memory, and does not include various forms of coping skills training or parent-focused sessions as in TF-CBT.

The current trial was designed to fill gaps in the existing literature by assessing the efficacy of EMDR and CBWT for childhood PTSD tied to a single traumatic event, in a large treatment-seeking sample, using a delayed-treatment control group, and a longer follow-up period. We hypothesized that EMDR and CBWT would both be superior to delayed-treatment in achieving remission from PTSD and reducing child- and parent-reported symptoms of PTSD, anxiety, depression, and behavior problems; and gains in both treatments would be maintained at 3-and 12-month follow-ups.

Methods

Study design and participants

This study was a multicenter, single-blind, parallel-group study with three arms: EMDR, CBWT, and wait-list (WL). Participants were recruited from among new referrals to seven child and adolescent mental health clinics spread across the Netherlands. Recruitment occurred over 2.5 years (September 2010 – March 2013; 1-year follow-up until June 2014). The study was approved by the Ethics Committee of the University of Amsterdam and registered in the Dutch Trial Register (www.trialregister.nl, 3870 or NTR3870).

Inclusion and exclusion criteria

Participants were: (a) aged 8–18 years; (b) able to read/write and communicate in the Dutch language; and (c) had a primary DSM-IV diagnosis of PTSD or subthreshold PTSD, with the PTSD symptoms being tied to a single traumatic event that occurred at least one month prior to trial assessment. Subthreshold PTSD was defined in one of two ways: (a) exposure to a traumatic event (Criterion A) plus the presence of ≥5 symptoms with at least one symptom each from Criterion B (re-experiencing), Criterion C (avoidance and numbing), and Criterion D (hyper arousal), plus symptom duration of at least one month (Criterion E), and clinically significant impairment in at least one aspect of functioning (Criterion F); or (b) Criterion A, plus fulfilling the minimum symptom requirements for two of the three symptom criteria (B, C or D), plus meeting Criterion E and F. Our decision to define subthreshold PTSD in two ways was based on previous trials where the 5-symptom definition was used (e.g. Mannarino, Cohen, Deblinger, Runyon, & Steer, 2012) and the literature that define caseness as a combination of symptoms from at least two diagnostic clusters (AACAP, 2010; Carrion, Weems, Ray, & Reiss, 2002).

Exclusion criteria were: (a) the presence of symptoms other than PTSD in more urgent need of treatment (e.g. suicidal intent/acts, acute psychosis); (b) ongoing exposure to a severe threat to the child's safety; (c) starting psychotropic medication within three months of trial assessment; (d) currently receiving another form of psychological treatment; and (e) an IQ estimated to be ≤80 based on information contained in the medical history or referral letter.

Procedure

After baseline assessment and informed written consent, eligible youth were randomized to EMDR, CBWT, or WL using a parallel design, blocked randomization per therapist, with five randomizations per block in the ratio of 2:2:1 (EMDR: CBWT:WL). The allocation ratio was chosen to ensure a sufficient sample size in the WL group for meaningful statistical comparisons with EMDR and CBWT, and to withhold immediate treatment from as few participants as possible for ethical reasons. Cards with names of the trial arms were kept in sequentially numbered, identical, opaque, sealed envelopes. The cards in the envelopes were shuffled and drawn by an independent randomization-assistant who revealed the allocation to the therapist. After the 6-week wait, WL participants still meeting inclusion criteria were rerandomized to EMDR or CBWT in the ratio of 1:1. Assessments were carried out at baseline, posttreatment/wait-list, and 3- and 12-months posttreatment by independent assessors blinded to treatment allocation. Participants received financial compensation of 15 Euro's for completing all post- and follow-up measures.

Primary outcome measures

(a) PTSD symptoms measured by the child and parent versions of the Revised Children's Responses to Trauma Inventory (CRTI; Alisic & Kleber, 2010); and (b) DSM-IV PTSD diagnostic status assessed by the Anxiety Disorders Interview Schedule, Child and Parent Version (ADIS-C/P; Silverman & Albano, 1996). ADIS-C/P interviews were conducted by seven clinical

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psychologists trained to use the ADIS-C/P to assess PTSD and who did not provide trial treatments. All interviews were audiotaped and 10% randomly selected, stratified by assessor and time of measurement, so that a selection of pretreatment (n = 18), posttreatment (n = 12), and follow-up interviews (n = 22) could be rerated by a psychologist with experience of carrying out ADIS-C/P interviews. Interrater reliability for PTSD diagnosis (including subthreshold) based on the ADIS-C/P was κ = .822 (child interview) and κ = .634 (parent interview). The Clinician Administered PTSD Scale – Child and Adolescent Version (CAPS-CA; Nader et al., 1996), a structured diagnostic interview often used in pediatric PTSD trials, had not been translated and validated in a Dutch version when this study began.

Secondary outcome measures

(a) Children's Post Traumatic Cognitions Inventory (C-PTCI; Meiser-Stedman et al., 2009; Diehle, de Roos, Meiser-Stedman, Boer, & Lindauer, 2015); (b) Revised Child Anxiety and Depression Scale, Child and Parent Version (RCADS-C/P; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000); (c) Strengths and Difficulties Questionnaire, Adolescent and Parent Version (SDQ-A/P; Goodman, 2001); (d) Child Somatization Inventory, Child and Parent Version (CSI-C/P; Meesters, Muris, Ghys, Reumerman, & Rooijmans, 2003); and (e) the quality of life measure Kidscreen-27, Child and Parent Version (Ravens-Sieberer et al., 2007). Participants who experienced the sudden death of a loved one as part of their index trauma, also completed the Inventory of Prolonged Grief for Children and Adolescents (IPG; Spuij et al., 2012).

Interventions

Eye movement desensitization and reprocessing and CBWT were manual-based and delivered in up to six weekly individual sessions lasting up to 45 min each, with no homework assignments, no separate sessions for parents, and no instructions given to parents to encourage their child to discuss the trauma or to confront reminders (see Appendix S1 for detailed information). Session duration was timed with a stop watch by the therapist. In session 1 of both treatments, information about PTSD and a brief explanation of the allocated treatment was offered to the youth and their parents. Thereafter, sessions were individual with 5 min at the start and end of each session for parents share their observations about their child's functioning over the past week. Treatment completion was defined as receiving six sessions, or less if: (a) Subjective Units of Distress Scale (SUDS) score was zero for the index traumatic memory in the EMDR condition or the written narrative was completed in the CBWT condition; and (b) there was agreement between the child, parents and therapist that the PTSD symptoms were sufficiently reduced to warrant terminating treatment. At the end of treatment, participants were asked to refrain (if possible) from engaging in further treatment for the length of the first follow-up period (3 months) but if needed, additional treatment was offered.

EMDR. Treatment followed the standard 8-phase protocol of Shapiro (2001) with age-appropriate modifications suggested by Tinker and Wilson. (1999) and Greenwald (1999), using the Dutch translation of the EMDR protocol for children and adolescents. The phases are: history taking, treatment planning, preparation, reprocessing, installation of a positive cognition, check for and processing any residual disturbing body sensations, positive closure and evaluation.

CBWT. This is manualized trauma-focused CBT, including psychoeducation, imaginal exposure, cognitive restructuring, promoting healthy coping strategies, and enlisting support from loved ones or friends (social sharing). The core feature of CBWT is the production of a detailed written narrative of the index trauma on a computer (for a full description see Van der Oord et al., 2010).

Wait-list. Participants were given an appointment for reassessment for six weeks after randomization and told they would be randomly allocated to EMDR or CBWT (if needed) with treatment beginning within one week after allocation. WL participants were given a contact telephone number in the event of crisis or significant worsening in symptoms.

Treatment fidelity/integrity

Trial therapists were 21 licensed clinical psychologists who provided both treatments in equal numbers but patients were not randomly allocated to therapists for logistical reasons. All trial therapists completed accredited courses in EMDR (3–4 days) and CBWT (2 days) and attended monthly supervision groups of one hour (each) of EMDR and CBWT, involving review of EMDR- and CBWT-specific protocol checklists and videotapes of sessions. Additional supervision was provided via e-mail and telephone upon request. A total of 122 videotapes (33%) of treatment sessions were randomly selected (EMDR = 54; CBWT = 68), stratified on treatment arm, therapist and session and rated for adherence by two psychology graduates who were blinded to outcome and trained to assess adherence (and contamination) using EMDR- and CBWT-specific fidelity checklists. Treatment adherence was very high for both conditions (EMDR = 97%; CBWT = 100%).

Statistical analysis

A priori power analyses indicated 100 participants were needed to have 80% power to detect large effect sizes (Cohen's d = 1.2) between the two treatments and WL at $p \leq .05$. Baseline differences were analyzed using parametric and nonparametric tests. Between-group comparisons on primary and secondary outcomes were carried out per the intention-to-treat principle using linear mixed models (LMM) including all randomized participants regardless of missing data. EMDR and CBWT versus WL comparisons were for pre-to-post treatment changes in outcome. EMDR versus CBWT comparisons were for changes in outcome from pretreatment to 12-month follow-up. WL participants reallocated after 6 weeks to EMDR/CBWT were not included in follow-up analyses. Any possible effect of waiting would not be independent from the subsequent effect of trauma treatment as it concerns the same individuals and may influence the outcome. Different models were estimated to compare differences between the three arms. All models included fixed coefficients to account for baseline differences and differential change over time between arms, and a random intercept to capture individual baseline differences. As 99 of 103 participants completed treatment, no separate completer-analyses were conducted. SPSS version 20.0 (IBM Corp, Armonk, NY) was used for all analyses. Further information about the calculation of effect sizes, reliable change, and number needed to treat is included in Appendix S2.

Results

Inclusion, attrition, and treatment variables

Figure 1 presents the CONSORT flow-chart. All 103 participants were included in the intent-to-treat analyses. Tolerance for both treatments was quite high with only two drop-outs prior to posttreatment

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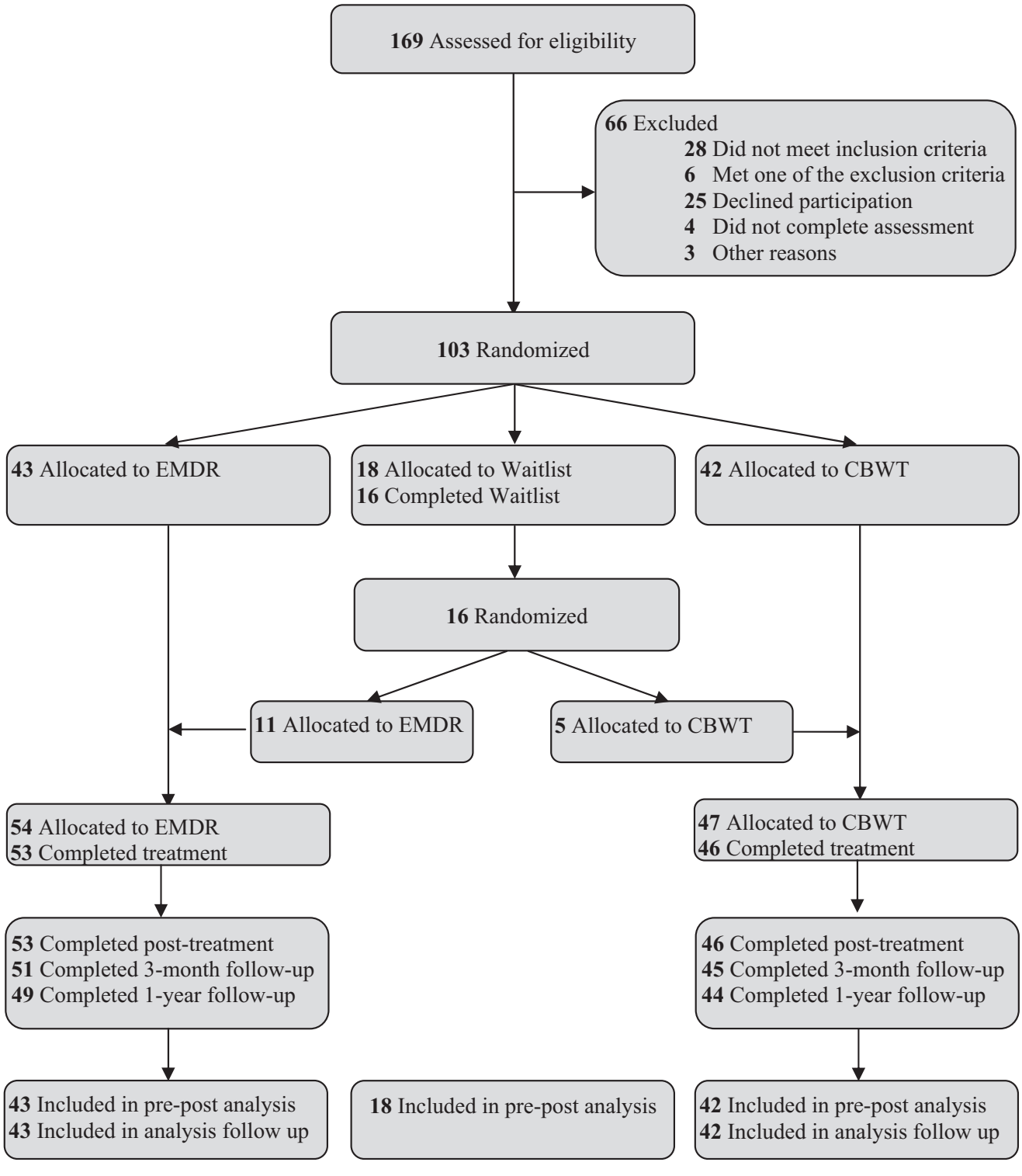

Figure 1 Flow of participants through the trial. Abbreviations: EMDR, eye movement desensitization and reprocessing; CBWT, cognitive behavioral writing therapy

assessment: one child (2.3%) from EMDR was reported to the police as missing and one child (2.4%) from CBWT was placed outside of the home during treatment. Of the 18 participants randomized to WL, 16 (88.9%) completed the 6-week WL: one dropped out because of suicidal ideation, and one declined further participation. The remaining WL participants were randomly allocated to EMDR (n = 11) or CBWT (n = 5) at the end of the waiting period.

Eye movement desensitization and reprocessing was significantly briefer than CBWT for mean number of treatment sessions (EMDR = 4.1, SD = 1.3, range = 2–6; vs. CBWT = 5.4, SD = 0.78, range = 3–6; $t(64.52) = -5.44$; $p < .001$) and mean length of treatment in minutes (EMDR = 140, SD = 76.61 vs. CBWT = 227, SD = 67.50; $t(80.17) = -5.49$; $p < .001$). Thirteen participants sought further psychological treatment during the first follow-up interval:

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two for PTSD symptoms (EMDR = 1; CBWT = 1); five for issues of current safety (EMDR = 3; CBWT = 2); and six for eating, behavioral, or mood disturbances (EMDR = 3; CBWT = 3).

Table 1 provides information about gender, age, ethnicity, type of trauma, time since trauma, and proportion of participants meeting diagnostic criteria for PTSD and comorbid disorders (any) by trial arm. No significant differences were found between arms for these variables. Also, there were no differences between the three arms at baseline for primary and secondary outcomes with the exception that total child-reported anxiety and depression (RCADS-C) was higher in the CBWT than the EMDR group.

Results for the primary outcomes are presented in Tables 2 and 3. Table 2 presents the means and standard deviations, LMM test statistics, and pre-to-post effect sizes for the CRTI. Compared to WL, EMDR and CBWT participants experienced significant pre-to-post treatment reductions in the frequency of child- and parent-reported PTSD symptoms. EMDR and CBWT did not differ at posttreatment on the CRTI. Improvements (intent-to-treat) in PTSD symptom severity from pre-to-post treatment were maintained at the 3- and 12-month follow-ups for EMDR and CBWT. However, EMDR participants made further improvements on child- and parent-reported PTSD symptoms from 3-month to 12-month follow-up ($t(80.72) = -2.28$, $p = .025$ and $t(75.91) = -2.89$, $p = .005$, respectively). The reliable change index (RCI) for child- and parent-reported PTSD symptoms as measured by the CRTI were as follows: (a) EMDR: RCI_{child} [(83.27–51.03)/7.18] = 4.49 and RCI_{parent} [(84.15–58.86)/8.54)] = 2.96; CBWT: RCI_{child} [(90.93–56.63)/8.19] = 4.19 and RCI_{parent} [(88.25–61.94)/9.69)] = 2.72. As all RCIs exceeded 1.96; changes in PTSD symptoms were more likely due to the effects of treatment than measurement error.

Table 3 presents the percentage of participants no longer meeting diagnostic criteria for PTSD and the percentage of participants still meeting subthreshold criteria. Remission rates were significantly higher for EMDR than WL based on the child and parent interviews (ADIS-C: Fisher exact = 22.89, $p < .001$; ADIS-P: Fisher exact = 16.50, $p < .001$) and also for CBWT versus WL (ADIS-C: Fisher exact = 16.50, $p < .001$; ADIS-P: Fisher exact = 16.65, $p < .001$). Remission rates in the EMDR group improved significantly from 3- to 12-month follow-up (ADIS-P: Fisher exact = 6.61, $p = .028$). EMDR and CBWT did not differ for remission rates at posttreatment or follow-up, except at the 12-month follow-up and based only on the parent interview (ADIS-P: Fisher exact = 5.97, $p = .029$). The number needed to treat (NNT) for EMDR was [ADIS-C: 1/(.70 - .059); ADIS-P: 1/(.711–.133)] = 1.56/1.73 and for CBWT was [ADIS-C: 1/(.561 - .059); ADIS-P: 1/(.732–.133)] = 1.99/1.67.

Table 4 presents the results for the secondary outcomes. Compared to WL, EMDR and CBWT participants experienced significant reductions in negative trauma-related cognitions (C-PCTI), in child-reported symptoms of anxiety and depression (RCADS-C), and parent-reported emotional/behavioral symptoms (SDQ-P). EMDR proved superior to WL for child-reported behavioral symptoms (SDQ-C) and quality of life (Kidscreen-C). CBWT was superior to WL for parent-reported anxiety and depression symptoms (RCADS-P). For within-group differences from 3- to 12-month follow-up, EMDR participants reported further reductions in negative trauma-related beliefs (C-PTCI: $t(80.32) = -2.89$, $p = .005$), and CBWT participants further reductions in

Table 1 Baseline sociodemographic and clinical characteristics by trial arm and for all participants, and comparisons between arms

Variable	EMDR ($n = 43$)	CBWT ($n = 42$)	WL ($n = 18$)	All ($n = 103$)	Statistic
Age, mean (*SD*), year	12.96 (3.05)	13.41 (2.76)	12.47 (2.98)	13.06 (2.92)	$F(2) = .71$, $p = .50$
Female, no. (%)	23 (53.5)	25 (59.5)	11 (61.1)	59 (57.3)	$\chi^2(2) = .45$, $p = .80$
Immigrant, no. (%)	11 (25.6)	14 (33.3)	4 (22.2)	29 (28.2)	$\chi^2(2) = 1.01$, $p = .60$
Time since trauma, mean (*SD*), months	18.30 (26.00) Range 1–115	16.26 (22.35) Range 1–80	13.00 (17.67) Range 1–74	16.54 (23.12) Range 1–115	$F(2) = .33$, $p = .72$
Full PTSD ADIS-C, no. (%)	26 (60.5)	26 (61.9)	11 (61.1)	63 (61.2)	$\chi^2(2) = .02$, $p = .99$
Full PTSD ADIS-P, no. (%)	26 (65.0)	24 (57.1)	11 (64.7%)	61 (61.6%)	$\chi^2(2) = .62$, $p = .73$
One or more comorbid disorder ADIS-C, no. (%)	21 (48.8)	25 (59.5)	10 (55.6)	56 (54.4)	$\chi^2(2) = .99$, $p = .61$
One or more comorbid disorder ADIS-P, no. (%)	25 (58.1)	19 (45.2)	8 (44.4)	52 (50.5)	$\chi^2(2) = 1.73$, $p = .42$
Trauma type, no. (%)					
Physical abuse/assault	13 (30.2)	6 (14.3)	5 (27.8)	24 (23.3)	$\chi^2(8) = 12.61$, $p = .13$
Sexual abuse	10 (23.3)	11 (26.2)	6 (33.3)	27 (26.2)	
Accident/injury of a loved one	4 (9.3)	14 (33.3)	2 (11.1)	20 (19.4)	
Traumatic loss	10 (23.3)	5 (11.9)	4 (22.2)	19 (18.4)	
Disaster/other	6 (14.0)	6 (14.3)	1 (5.6)	13 (12.6)	

Full PTSD means that participants met or exceeded the DSM-IV criteria for a diagnosis of PTSD. The remaining participants fulfilled inclusion criteria for subthreshold PTSD.

EMDR, Eye movement desensitization and reprocessing; CBWT: cognitive behavioral writing therapy; PTSD, posttraumatic stress disorder.

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Table 2 Means and standard deviations for child- and parent-reported PTSD symptoms at pre, posttreatment and follow-up (intention-to-treat) by condition and between-condition comparisons

	Condition										LMM Intention-to-Treat							
	EMDR $n = 43$				CBWT $n = 42$				WL $n = 18$		EMDR versus WL			CBWT versus WL			EMDR versus CBWT	
	Pre *M (SD)*	Post *M (SD)*	3 months *M (SD)*	12 months *M (SD)*	Pre *M (SD)*	Post *M (SD)*	3 months *M (SD)*	12 months *M* (SD)	Pre *M (SD)*	Post *M (SD)*	*t*	*p*	*d*	*t*	*p*	*d*	*t*	*p*
CRTI Child																		
Total score	83.27 (20.74)	51.03 (19.23)	51.96 (20.58)	47.46 (11.37)	90.93 (23.64)	56.63 (22.05)	54.30 (20.22)	51.53 (18.34)	86.18 (20.52)	80.16 (23.52)	−4.51	<.001	1.27	−4.87	<.001	1.24	−.52	.60
Intrusion	16.91 (5.98)	9.15 (3.81)	9.36 (4.03)	8.68 (2.41)	19.38 (5.62)	10.66 (4.57)	9.75 (3.84)	18.00 (5.85)	15.69 (4.53)	15.69 (4.53)	−3.55	<.001	.92	−4.14	<.001	1.13	−.79	.43
Avoidance	28.91 (8.58)	16.68 (7.44)	17.53 (8.70)	14.95 (5.23)	28.60 (8.33)	17.85 (7.69)	16.55 (7.20)	27.88 (6.43)	26.11 (9.70)	26.11 (9.70)	−4.80	<.001	1.30	−4.13	<.001	1.15	.92	.36
Arousal	15.81 (5.52)	10.30 (4.80)	10.08 (4.35)	10.05 (3.30)	18.60 (6.43)	12.05 (5.14)	11.68 (5.15)	16.41 (5.83)	16.41 (5.83)	16.06 (5.47)	−3.32	<.001	.92	−4.03	<.001	0.99	−.95	.35
O. Ch-Spec. Reactions	21.67 (6.23)	14.90 (5.04)	14.95 (5.17)	14.05 (4.17)	24.54 (7.74)	16.07 (6.97)	16.33 (6.63)	15.29 (6.71)	23.88 (6.55)	22.31 (7.49)	−2.88	.005	.82	−3.78	<.001	.93	−1.37	.18
CRTI Parent																		
Total score	84.15 (22.82)	58.86 (18.14)	59.03 (22.06)	50.00 (15.01)	88.25 (25.91)	61.94 (23.06)	58.55 (22.37)	57.61 (24.86)	86.28 (17.38)	81.74 (23.45)	−3.41	<.001	.97	−3.64	<.001	.92	−.25	.80
Intrusion	17.29 (6.05)	11.08 (3.88)	10.95 (4.53)	9.30 (3.29)	17.95 (5.56)	12.49 (4.73)	10.53 (4.45)	10.50 (4.24)	16.33 (6.96)	16.33 (6.96)	−2.81	.006	.76	−2.37	.02	.67	.61	.54
Avoidance	27.50 (8.71)	19.16 (6.52)	18.72 (8.05)	16.22 (5.49)	27.95 (9.77)	19.30 (8.35)	18.50 (8.59)	18.34 (9.47)	27.56 (8.43)	27.05 (7.66)	−3.48	<.001	.91	−3.73	<.001	.87	−.25	.80
Arousal	16.81 (5.25)	11.84 (4.62)	12.71 (5.78)	9.95 (3.92)	18.19 (6.54)	12.17 (4.72)	12.13 (4.92)	11.84 (5.29)	17.56 (3.26)	16.40 (4.69)	−2.19	.03	.80	−3.00	.003	.84	−1.02	.31
O. Ch-Spec. Reactions	22.74 (7.02)	16.78 (6.04)	16.59 (6.45)	14.54 (4.81)	24.16 (8.18)	17.98 (7.18)	17.40 (6.69)	16.92 (7.33)	23.06 (6.42)	21.93 (7.31)	−2.61	.01	.70	−2.63	.010	.66	.01	.99

WL, Wait-List; EMDR, eye movement desensitization and reprocessing; CBWT, cognitive behavioral writing therapy; LMM, Linear Mixed Model; CRTI, Children's Responses to Trauma Inventory. O. Ch-Spec. Reactions, Other Child-Specific Reactions; PTSD, posttraumatic stress disorder.

Between-group effect sizes are Cohen's *d* based on the means and standard deviations from the LMM procedure. The reported effect sizes concern the differences between the treatment conditions (EMDR or CBWT) and wait-list and at posttreatment.

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Table 3 Proportion of participants no longer meeting DSM-IV PTSD and still meeting subthreshold PTSD diagnostic criteria at posttreatment and follow-up

	Posttreatment/Wait-List			3-Month FUP		12-Month FUP	
	EMDR	CBWT	WL	EMDR	CBWT	EMDR	CBWT
ADIS-Child	$n = 40$	$n = 41$	$n = 17$	$n = 40$	$n = 39$	$n = 38$	$n = 38$
% No PTSD (*n*)	92.5[a] (37)	90.2[a] (37)	52.9[b] (9)	95.0[a] (38)	87.2[a] (34)	100[a] (38)	92.1[a] (35)
% Subthr PTSD (*n*)	22.5 (9)	34.1 (14)	47.1 (8)	22.5 (9)	17.9 (7)	18.4 (7)	15.8 (6)
ADIS-Parent	$n = 38$	$n = 41$	$n = 15$	$n = 38$	$n = 39$	$n = 36$	$n = 35$
% No PTSD (*n*)	92.1[a] (35)	82.9[a] (34)	53.3[b] (8)	86.8[a] (33)	89.7[a] (35)	100[b] (36)	88.6[a] (31)
% Subthr PTSD (*n*)	21.1 (8)	9.8 (4)	40.0 (6)	13.2 (5)	10.3 (4)	5.6 (2)	14.3 (5)

FUP, Follow-up assessment; ADIS, Anxiety Disorders Interview Schedule for DSM-IV; WL, Wait-List; EMDR, eye movement desensitization and reprocessing; CBWT, cognitive behavioral writing therapy. Subthr: subthreshold. WL ($n = 17$): one of the dropouts partly completed the post wait-list assessment. No posttraumatic stress disorder (PTSD) means participants no longer met DSM-IV criteria for PTSD based on ADIS-C/P; Still subthreshold PTSD: ≥5 DSM-IV PTSD symptoms with at least one symptom in each Criteria (B, C, D) plus Criterion E/F met *or* fulfilling minimum symptom requirements for two of the three symptom Criteria (B, C, D) plus Criterion E/F met. Proportions sharing the same superscript are not significantly different from each other; $p \leq .05$ for all 2×3 Fisher-Freeman-Halton Exact comparisons for EMDR versus WL and CBWT versus WL; $p \leq .029$ for EMDR versus CBWT at 12-month FUP (ADIS-P) and $p \leq .028$ for EMDR 3-month FUP versus EMDR 12-month FUP (ADIS-P).

child-reported somatic symptoms (CSI-C: $t(79.33) = -2.45$, $p = .016$). No further improvements from 3- to 12-month follow-ups were found. For between-group differences at follow-up, EMDR and CBWT were similar on all secondary outcomes with the exception that EMDR participants reported further improvements in child- and parent-reported quality of life between posttreatment and the 3-month follow-up and between 3-month and 12-month follow-up, respectively (Kidscreen-27-C: $t(81.65) = -2.38$, $p = .02$; Kidscreen-27-P: $t(74.83) = -2.848$, $p = .01$). For the subgroup that had experienced death of a loved one, there were no significant improvements on the IPG for all measurements.

Discussion

The present trial is the first three-arm RCT demonstrating the efficacy of EMDR and a brief form of trauma-focused CBT compared to wait-list (WL) for pediatric PTSD following a single-incident traumatic event, and the first RCT with youth using computer-aided CBWT. Consistent with our hypotheses, both EMDR and CBWT yielded high rates of diagnostic remission from (subthreshold) PTSD with attrition during treatment being extremely low, supporting the feasibility and tolerance of both treatments. The recovery rates for EMDR and CBWT are in line with the intent-to-treat remission rates of one other single-incident PTSD study using trauma-focused cognitive therapy (92%, Smith et al., 2007), but were higher than those reported by other single-incident PTSD studies (i.e. CBT 65%, cognitive therapy 56%, Nixon, Sterk, & Pearce, 2012; prolonged exposure 68%, time-limited psychodynamic therapy 37%, Gilboa-Schechtman et al., 2010).

As hypothesized, both treatments yielded clinically significant reductions in child- and parent-reported symptoms of PTSD, anxiety, depression, and behavior problems – and negative trauma-related appraisals reported by the child. No differences were found between EMDR and CBWT for the primary outcomes (PTSD), and most of the secondary outcomes at posttreatment, and 3- and 12- month follow-ups. The intention-to-treat, between-group, pre-to-post treatment effect sizes for EMDR and CBWT on child-reported PTSD symptoms ($d = 1.27$; $d = 1.24$, respectively) were larger than the mean posttreatment between-group effect sizes for psychological interventions reported in recent meta-analytic reviews of the child PTSD literature (Standard Mean Difference/Hedge's $g = -.42$ to .83, Gillies et al., 2016; Morina et al., 2016 respectively).

Participants in both EMDR and CBWT maintained (or improved slightly) on the primary and secondary outcomes from posttreatment to the 3-month follow-up and importantly, between the 3- and 12-month follow-ups. EMDR participants made further gains compared to CBWT on child- and parent-reported PTSD symptoms (CRTI) between the 3- and 12-month follow-ups. We note that 12 months after treatment, diagnostic remission reached 100% for EMDR participants based on child and parent interviews. However, these further gains were only significant for EMDR from 3 to 12 month follow-up and relative to CBWT at 12-month follow-up for parent-rated PTSD. Overall, the differences between the two treatments during the follow-up period were relatively few (and minor in a clinical sense) and thus EMDR and a form of trauma-focused CBT were comparably effective in this trial.

While not a primary aim of the trial, we note the relative efficiency of EMDR and CBWT in reducing PTSD symptoms and associated difficulties. Both yielded significant reductions in a broad range of symptoms after a very limited time spent in treatment sessions, an average of 2 hr and 20 min for EMDR versus 3 hr and 47 min for CBWT. To this end, these results are consistent with previous EMDR trials in youth (De Roos et al., 2011; Jaberghaderi et al., 2004) suggesting an incremental efficiency of EMDR compared to CBT protocols for

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Table 4 Means and standard deviations for secondary outcome measures at pre, posttreatment and follow-up (intention-to-treat) by condition and results for between-condition comparisons

	Condition										LMM Intention-to-Treat							
	EMDR $n = 43$				CBWT $n = 42$				WL $n = 18$		EMDR versus WL			CBWT versus WL			EMDR versus CBWT	
	Pre *M (SD)*	Post *M (SD)*	3 months *M (SD)*	12 months *M* (SD)	Pre *M (SD)*	Post *M (SD)*	3 months *M (SD)*	12 months *M* (SD)	Pre *M (SD)*	Post *M (SD)*	*t*	*p*	*d*	*t*	*P*	*d*	*t*	*p*
CPCTI Child	45.25 (13.12)	34.79 (12.34)	35.58 (14.07)	30.46 (7.35)	48.44 (14.86)	36.56 (12.64)	37.36 (15.34)	33.87 (12.21)	48.43 (15.69)	43.46 (14.09)	−2.26	.03	.39	−2.86	.005	.46	−.79	.43
RCADS Child	33.93 (19.88)	17.90 (19.18)	16.53 (17.55)	13.39 (11.66)	43.89 (20.49)	24.63 (20.02)	22.88 (21.52)	19.97 (18.84)	36.49 (20.83)	29.50 (18.09)	−2.64	.01	.45	−3.69	<.001	.60	−1.31	.20
RCADS Parent	35.67 (19.33)	23.14 (16.31)	21.05 (19.25)	16.92 (12.91)	40.22 (22.33)	24.98 (17.44)	22.70 (17.94)	22.83 (16.74)	33.22 (20.44)	30.13 (18.11)	−1.94	.06	.48	−2.60	.01	.56	−.82	.42
SDQ Child	13.93 (6.02)	8.38 (5.20)	8.89 (5.80)	7.57 (4.27)	14.72 (7.17)	11.63 (5.63)	11.75 (5.90)	10.37 (5.44)	14.00 (4.30)	14.22 (3.60)	−2.56	.01	1.03	−1.54	.13	.51	1.48	.14
SDQ Parent	13.00 (5.72)	8.84 (4.92)	8.56 (6.29)	7.92 (5.28)	12.93 (6.58)	9.59 (5.65)	8.73 (6.18)	8.47 (5.77)	10.44 (4.59)	11.00 (4.41)	−2.97	.004	.87	−2.60	.01	.64	.51	.61
CSI Child	18.07 (17.43)	9.75 (11.31)	10.05 (12.45)	8.08 (8.41)	23.63 (17.88)	18.04 (20.64)	18.37 (19.99)	13.37 (14.24)	21.51 (14.42)	19.06 (17.10)	−1.60	.11	.35	−1.49	.14	.19	.11	.91
CSI Parent	14.18 (17.00)	7.19 (9.02)	8.21 (10.10)	6.70 (8.15)	17.59 (17.62)	10.23 (11.72)	9.55 (10.13)	9.55 (10.07)	16.84 (18.66)	12.67 (12.42)	−5.80	.56	.16	−.77	.44	.18	−.24	.81
Kidscreen-27 Child	102.88 (15.60)	113.11 (15.84)	112.99 (15.06)	115.50 (12.16)	98.93 (18.18)	106.41 (16.90)	104.30 (18.79)	107.90 (19.30)	104.83 (10.80)	105.90 (16.66)	2.56	.01	.50	1.87	.06	.39	−.88	.38
Kidscreen-27 Parent	101.31 (12.35)	108.34 (12.66)	106.36 (14.35)	109.59 (11.37)	101.01 (17.55)	109.36 (14.29)	110.25 (14.12)	106.89 (15.22)	102.80 (14.02)	104.33 (12.77)	1.35	.18	.43	1.70	.09	.41	.50	.62
IPG Child	60.30 (16.43)	40.90 (12.61)	42.44 (13.13)	41.22 (10.16)	50.60 (19.48)	38.20 (8.23)	38.00 (9.43)	36.60 (5.22)	60.00 (18.13)	42.67 (10.07)	−.44	.67	.12	.26	.80	.26	.80	.44

WL, Wait-List; EMDR, eye movement desensitization and reprocessing; CBWT, cognitive behavioral writing therapy; LMM, Linear Mixed Model; c-PTCI, Children's PostTraumatic Cognitions Inventory; RCADS, The Revised Child Anxiety and Depression Scale; SDQ, Strengths and Difficulties Questionnaire; CSI, Children's Somatization Inventory; IPG, Inventory of Prolonged Grief.

Between-group effect sizes are Cohen's *d* based on the means and standard deviations from the LMM procedure. The reported effect sizes concern the differences between WL and treatment conditions (EMDR or CBWT) at postmeasurement; WL child SDQ $n = 11$.

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PTSD in children albeit further trials are needed. The brevity of both interventions (i.e. around half the duration compared to standard trauma-focused CBT protocols) is an important and novel finding. The apparent efficiency of both treatments may reflect the fact that they discard components that may be unnecessary or minimally active (e.g. a stabilization phase, coping skills training, or parent-focused interventions).

The study benefitted from several strengths including: multisite recruitment of participants from among standard clinical referrals; broad inclusion criteria; a large sample size including both children and adolescents; a delayed-treatment control group; blinded multi-informant diagnostic assessments; manualized treatments with independent fidelity checks; and a 12-month follow-up. Still, several limitations are noted. Our findings may not generalize to children below 8 years of age or to those with PTSD tied to multiple traumatic events. However, there is evidence that youth aged 8–18 years exposed to multiple traumas respond well to brief, trauma-focused treatments including EMDR and CBT (Diehle et al., 2014; Van der Oord et al., 2010). While the treatment manuals used in this trial may be disseminated into routine care, similar outcomes may not be achieved without access to similar levels of training and regular supervision from similarly qualified experts. Generalization studies are needed. Finally, although participants were specifically asked not to disclose their treatment condition, it cannot be ruled out that some posttreatments assessors were unblinded.

In conclusion, EMDR and CBWT, involving no training in coping skills (emotion-regulation) prior to trauma memory work and with minimal parental involvement, were acceptable, well-tolerated treatments that yielded clinically significant reductions in single-incident PTSD and comorbid difficulties in five sessions (lasting 45 min) or less, with gains being maintained up to one year posttreatment. Further research is warranted evaluating the efficacy and efficiency of EMDR and CBWT particularly in youth with PTSD symptoms arising from multiple traumas and below eight years of age.

Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Interventions: EMDR and CBWT.

Appendix S2. Information about the calculation of effect sizes, reliable change, and number needed to treat.

Figure S1. CONSORT 2010 checklist of information to include when reporting a randomized trial.

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Correspondence

Carlijn de Roos, Psychotraumacenter for Children and Youth, Rivierduinen, Sandifortdreef 19, 2300 AK, Leiden, The Netherlands; Email: c.deroos@rivierduinen.nl

Key points

- Very few RCTs have involved youth, exposed to a single-incident trauma, who were seeking treatment for PTSD from child and adolescent mental health services.
- EMDR and CBWT are manualized, time-limited interventions that were well-tolerated and effective for PTSD and comorbid symptoms relative to wait-list (WL). Treatment effects were maintained at 3- and 12-month follow-ups.
- Trauma treatment for youth with PTSD tied to a single-incident trauma can be effective with minimal parental involvement and without training in coping skills (emotion-regulation).

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