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Effectiveness of an intensive treatment programme combining prolonged exposure and EMDR therapy for adolescents suffering from severe post-traumatic stress disorder

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ABSTRACT

Background: Following promising effects of an intensive trauma treatment for adults, the question arises whether adolescents who suffer from severe post-traumatic stress disorder (PTSD) can also profit from a similar treatment programme.

Objective: To assess the effectiveness of an intensive trauma-focused treatment programme combining two evidence-based trauma-focused therapies and physical activities for adolescents suffering from severe PTSD.

Method: Treatment consisted of daily sessions of prolonged exposure (PE) therapy and eye movement desensitization and reprocessing (EMDR) therapy supplemented with physical activity (13 days on average). All patients ($N = 27$; 96.3% women, mean age = 16.1 years; $SD = 1.3$) had been exposed to one or more (interpersonal) traumatic events. Twenty-two of them (81.5%) also fulfilled the diagnostic criteria of a comorbid psychiatric disorder (mean number of comorbid disorders = 2.22). The majority of patients were referred because previous treatment was difficult or complications were expected to occur. Severity of PTSD symptoms and presence of a PTSD diagnostic status were assessed using the Dutch version of the CAPS-CA IV at baseline, post-treatment and at 3-month follow-up.

Results: CAPS-CA IV scores decreased significantly from pre- to post-treatment (Cohen's $d = 1.39$). Of all patients 81.5% ($n = 22$) showed a clinically meaningful response, of whom 63% ($n = 17$) no longer fulfilled the diagnostic criteria of PTSD at post-treatment as established with the CAPS-CA IV. The results were maintained at 3-month follow-up. During treatment, neither adverse events nor dropout occurred.

Conclusions: The results suggest that an intensive trauma-focused treatment programme combining prolonged exposure, EMDR therapy, and physical activity can be an effective and safe treatment for adolescents suffering from severe PTSD and multiple comorbid psychiatric disorders.

Efectividad de un programa de tratamiento intensivo que combina exposición prolongada y terapia EMDR para adolescentes que padecen un trastorno de estrés postraumático severo

Antecedentes: Después de los efectos prometedores de un tratamiento intensivo del trauma para adultos, surge la pregunta de si los adolescentes que padecen un trastorno de estrés postraumático severo (TEPT) también pueden beneficiarse de un programa de tratamiento similar.

Objetivo: Evaluar la efectividad de un programa de tratamiento intensivo centrado en el trauma que combina dos terapias centradas en el trauma basadas en la evidencia y actividad física para adolescentes que sufren de TEPT grave.

Método: El tratamiento consistió en sesiones diarias de terapia de exposición prolongada (PE) y terapia de desensibilización y reprocesamiento por movimientos oculares (EMDR) complementadas con actividad física (13 días en promedio). Todos los pacientes ($N = 27$; 96.3% mujeres, edad media = 16,1 años; $DE = 1.3$) habían estado expuestos a uno o más eventos traumáticos (interpersonales). Veintidós de ellos (81.5%) también cumplían los criterios diagnósticos de un trastorno psiquiátrico comórbido (número medio de trastornos comórbidos = 2.22). La mayoría de los pacientes fueron derivados porque el tratamiento previo fue difícil o se esperaba que ocurrieran complicaciones. La gravedad de los síntomas de TEPT y la presencia del diagnóstico de TEPT se evaluaron utilizando la versión holandesa del CAPS-CA IV al inicio, después del tratamiento y a los 3 meses de seguimiento.

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KEYWORDS

PTSD; adolescents; intensive trauma-focused treatment; prolonged exposure; EMDR; physical activity

PALABRAS CLAVE

TEPT; adolescentes; tratamiento intensivo centrado en el trauma; exposición prolongada; EMDR; actividad física

关键词

PTSD; 青少年; 聚焦创伤强化治疗; 延长暴露; EMDR; 体育活动

HIGHLIGHTS

- The first study that investigated the effects of an intensive trauma-focused treatment programme combining prolonged exposure, EMDR therapy and physical activity for adolescents.
- No adverse events nor dropout occurred during treatment.

Resultados: Los puntajes de CAPS-CA IV disminuyeron significativamente pre a post tratamiento (d de Cohen = 1,39). De todos los pacientes, el 81,5% ($n = 22$) mostró una respuesta clínicamente significativa, de los cuales el 63% ($n = 17$) ya no cumplía con los criterios diagnósticos de TEPT en el postratamiento según lo establecido con el CAPS-CA IV. Los resultados se mantuvieron a los 3 meses de seguimiento. Durante el tratamiento, no se produjeron eventos adversos ni abandonos.

Conclusiones: Los resultados sugieren que un programa de tratamiento intensivo centrado en el trauma que combine exposición prolongada, terapia EMDR y actividad física puede ser un tratamiento eficaz y seguro para los adolescentes que padecen TEPT severo y múltiples trastornos psiquiátricos comórbidos.

结合延长暴露和 EMDR 治疗的强化治疗方案对患有严重创伤后应激障碍的青少年的有效性

背景: 在针对成年人的强化创伤治疗有前景的效果之后,关于患有严重创伤后应激障碍 (PTSD) 的青少年是否也可以从类似的治疗方案中受益的问题也产生了。

目的: 评估以结合两种循证聚焦创伤治疗和体育活动的聚焦创伤强化治疗方案对患有严重创伤后应激障碍青少年的有效性。

方法: 治疗包括每天进行的延长暴露时间 (PE) 治疗,眼动脱敏和再加工 (EMDR) 治疗以及体育活动 (平均13天)。所有患者 ($N = 27$; 96.3%为女性,平均年龄= 16.1岁; $SD = 1.3$) 都曾遭受一种或多种 (人际) 创伤事件。其中有22人 (81.5%) 满足精神障碍的共病诊断标准 (平均共病数= 2.22)。由于先前的治疗困难或预期的困难,因此转诊了大多数患者。在基线,治疗后和3个月的随访中,使用荷兰语版CAPS-CA IV对PTSD症状的严重程度和PTSD诊断状态的存在进行了评估。

结果: 从治疗前到治疗后, CAPS-CA IV评分显著降低 (Cohen's $d = 1.39$)。在所有患者中, 81.5% ($n = 22$) 表现出临床显著反应,其中63% ($n = 17$) 在治疗后不再符合CAPS-CA IV建立的PTSD诊断标准。此结果保持到了3个月的随访时。在治疗过程中,不良事件和患者流失均未发生。

结论: 结果表明,针对患有严重创伤后应激障碍和多种精神障碍共病的青少年,延长暴露,EMDR治疗和体育锻炼相结合的聚焦创伤强化治疗方案可能是一种有效而安全的治疗方法。

1. Introduction

Many children are exposed to one or more traumatic events during their lives before the age of 18. According to the National Prevalence Study Abuse of Children and Adolescents, in 2017, between 26 and 37 per 1000 children in the Netherlands have been abused, neglected or witnessed domestic violence (Alink, Prevoo, van Berkel, Linting, & Pannebakker, 2017; Alink et al., 2018). A meta-analysis evaluating 43 independent studies showed an overall prevalence rate of 15.9% of post-traumatic stress disorder (PTSD) in trauma-exposed children and adolescents. Children and adolescents who have been exposed to interpersonal trauma, for example, sexual and physical abuse, are most likely to develop PTSD (Alisic et al., 2014). These adverse childhood experiences have also been found to be long-lasting determinants of health risk behaviours, mental illness, social dysfunction, disability, death and increased healthcare costs (Felitti, 2002; Smith, Dalgleish, & Meiser-Stedman, 2019). Therefore, adequate trauma-focused treatment for children and adolescents with PTSD is important (John-Baptiste Bastien, Jongasma, Kabadayi, & Billings, 2020; Berliner et al., 2019b).

For the treatment of children and adolescents with clinically relevant levels of PTSD symptoms, current international treatment guidelines (Berliner et al., 2019a; National Institute for Care and Excellence, 2018; World Health Organization, 2013) recommend the application of trauma-focused cognitive-

behavioural therapy or eye movement desensitization and reprocessing (EMDR) therapy. The same holds true for children and adolescents who suffer from the disabling effects of early childhood traumatization. However, additional interventions targeting the individual's needs will often be necessary (Berliner et al., 2019a). An important complication in the treatment of children with severe PTSD, who suffered interpersonal childhood trauma, is a high dropout rate (Cohen, Mannarino, & Iyengar, 2011; Gilboa-Schechtman et al., 2010). As a consequence, a significant number of patients ultimately do not receive treatment they could benefit from. There is evidence suggesting that retention in treatment decreases when treatment is intensified: that is, applying a higher frequency of therapy sessions within a shorter time frame (Mevisen, Ooms-Evers, Serra, de Jongh, & Didden, 2020; Ragsdale, Watkins, Sherrill, Zwiebach, & Rothbaum, 2020; Sciarrino, Warnecke, & Teng, 2020; Silverstone, Greenspan, Silverstone, Sawa, & Linder, 2016). For instance, Hendriks et al. (2017) and her colleagues developed an intensive PE therapy programme and explored the effectiveness of this programme in 10 adolescent patients with severe PTSD and comorbid disorders following multiple interpersonal trauma. The results showed that all patients completed their treatment, in addition 40% of the adolescents reached diagnostic remission of their PTSD status from baseline to post-treatment and 80% from baseline to follow-up at 3 and 6 months.

More recently, brief, intensive trauma treatment programmes have been developed which combine several evidence-based treatments (i.e. prolonged exposure therapy and EMDR therapy, physical activity and psycho-education; van Minnen, Voorendonk, Roozendaal, & de Jongh, 2020; van Woudenberg et al., 2018). Such treatment programmes are considered to be safe, well tolerated, effective and show a high level of patient retention (i.e. 97.3%). The question arises whether this can also be helpful for adolescents.

Therefore, Accare Mental Health Institution (MHI) for Child and Adolescent Psychiatry started a similar inpatient treatment programme for adolescents aged 12 to 18 years. The purpose of the present study was to determine whether this brief, trauma-focused treatment programme could be effective for adolescents with severe PTSD following interpersonal trauma measured by using the golden standard for classifying PTSD in Children and Adolescents (CAPS-CA IV). We predicted that this treatment programme for adolescents would be associated with a significant decrease in PTSD symptoms as well as a decrease in the number of adolescents fulfilled the diagnostic criteria of PTSD. Furthermore, we predicted a similar drop-out rate compared to corresponding intensive treatment programmes (Hendriks et al., 2017; van Woudenberg et al., 2018; i.e. below 5%) and that the treatment programme would be safe (i.e. an absence of adverse events, such as no increase in suicidal ideation, no serious self-injurious behaviour and no crisis contacts) (Maercker et al., 2013; van Woudenberg et al., 2018; Zepeda Méndez, Nijdam, Ter Heide, Van Der Aa, & Olff, 2018).

2. Method

2.1. Participants

The patients included in this study received trauma-focused treatment from July 2018 to July 2019 for the duration of 2–4 weeks. In this period, 27 participants ($n = 26$, 96.3% women; mean age = 16.1; SD = 1.3) were referred by their general practitioner, psychologist, or psychiatrist from outpatient services to Accare intensive care department for trauma-related problems in the Netherlands. Of these patients, we consecutively included individuals fulfilled the following criteria: (1) aged between 12 and 18 years, (2) meeting the diagnostic criteria of PTSD according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (American Psychiatric Association [APA], 2000), and (3) had received trauma-focused treatment in an outpatient setting which was stopped prematurely due to severe dysregulation (such as (acute) suicidality, self-injurious risk behaviours or presumed high risk of decompensation) or trauma-focused treatment had not started because the risk of such

adverse events occurring was deemed too high based on the referring clinician.

2.2. Procedure

The study was performed in accordance with the regulations for research as stated in the Declaration of Helsinki and the Dutch Medical Research on Humans Act (World Medical Organization, 2001) concerning scientific research. All data were collected using the standard assessment instruments and the routine monitoring outcome procedures used by the Accare Mental Health Institution. The presence of a PTSD diagnosis and the level of severity of the PTSD symptoms were assessed using a clinician-rated interview by independent assessors (Lindauer, 2014; Nader et al., 2014, 2004). The assessment was carried out prior to treatment (T1), at the end of their treatment (T2) and at follow-up 3 months after treatment (T3).

2.3. Measure

The severity of PTSD symptoms as measured by the CAPS-CA IV (Nader et al., 2004; Dutch version: Lindauer, 2014) was used as the outcome measure. Due to the fact that the CAPS-CA V was under development and insufficiently researched in the Netherlands at the time of the study, the CAPS-CA IV was used in this study. The CAPS-CA IV is considered to be the golden standard for classifying PTSD in children and adolescents and provides ratings of the 17 DSM-IV-TR-based PTSD symptoms on a frequency scale (0–4) and an intensity scale (0–4). The total CAPS-CA IV score can range from 0 to 136. The ‘1/2’ rule was applied to determine a PTSD diagnosis which requires a frequency score of ≥ 1 and an intensity score of ≥ 2 for each symptom (Lindauer, 2014; Weathers, Keane, & Davidson, 2001). This rule is recommended within a clinical environment. Lindauer (2014) proposed the following five score categories: between 0 and 19 mild PTSD, between 20 and 39 mild PTSD, between 40 and 59 moderate PTSD, between 60 and 79 severe PTSD and between 80 and 136 very severe PTSD. The Dutch version of the CAPS-CA IV (2014) has good psychometric properties (Cronbach’s α : .42–.86), sufficient validity and excellent inter-rater reliability (.99; Diehle, de Roos, & Boer, 2014; Diehle, de Roos, Boer, & Lindauer, 2013; Diehle et al., 2014).

Comorbid diagnoses (DSM-IV) were mapped out through thorough systematic file analysis at the baseline of the study (diagnosed by the professionals of the outpatient treatment facility) and were determined on the basis of the DSM-IV (APA, 2000) and DSM-5 (APA, 2013).

Treatment related adverse events such as suicide attempts, serious self-harm (so-called risk behaviour) or symptom worsening were monitored during

treatment and follow-up and recorded in the files by the practitioners. Safety was defined as the absence of any adverse events, such as an increase in suicidal ideation, an increase in trauma symptoms, self-injurious behaviour or crisis contacts (Food and Drug Administration [FDA], 2016).

2.4. Treatment

Following the intensive trauma-focused treatment as described by van Woudenberg et al. (2018), the programme of Accare consists of a combination of two manualized evidence-based treatments for PTSD, that is, PE therapy in the morning, and EMDR therapy in the afternoon during five consecutive working days. Patients received two individual sessions per day for the duration of 60 minutes each, and twice a day patient would participate in physical activities lasting 60 minutes per session. Patients' information about their trauma history and PTSD symptoms was used to develop an individualized case conceptualization that included emotionally charged memories of traumatic events related to their PTSD. The memories were targeted in a sequence starting with the most disturbing memory. One specific memory was processed per day. The memory targeted with PE in the morning session was again targeted in the afternoon using EMDR therapy. The duration of the treatment was not determined in advance, but depended on the progress made with the predetermined target memories. In other words, treatment was terminated when the scores on the Units of Disturbance (SUD) Scale had reduced to zero for the indexed traumatic memories, and the PTSD symptomatology had been sufficiently decreased.

Each day a multidisciplinary meeting took place among the therapists in which information from the exposure session in the morning was transferred to the EMDR therapist who would conduct the afternoon session. The supervisors attended the daily multidisciplinary meetings. The therapists (exposure and EMDR therapy) rotated between the individual treatment sessions, which meant that patients had approximately five to seven different therapists (i.e. 'therapist rotation model'; van Minnen et al., 2018). The therapists provided psycho-education about PTSD before and during the treatment programme. In addition to the daily treatment schedule, the patients spent the remaining hours of the day either together with the rest of the patient group, for example, during meal times or spending their leisure time together, or on their own so they could work on school assignments. Patients were also able to receive visitors from their own network during their leisure time. Patients went home during the weekend. Further, the treatment programme did not contain any form of stabilization in that, prior to the processing of the traumatic memories, no relaxation or

emotion regulation skills were trained (for the rationale, see De Jongh et al., 2016).

2.4.1. Exposure therapy

A Dutch version of the PE therapy protocol based on Dancu and Foa (1992, 2007) was used (van Minnen & Arntz, 2017) for the PE therapy sessions. The treatment described, which includes imaginary exposure and exposure in vivo is based on the treatment originally described by Dancu and Foa (1992) and is internationally referred to as prolonged exposure. The patients were exposed to the memories of the traumatic events by imagining the memories as vividly as possible, while describing these aloud, in detail, in the present tense during the exposure sessions. In vivo material which reminded the patient of the traumatic event was subsumed in line with the concept of 'deepened extinction' (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). The addition of in vivo exposure to imaginary exposure has been found to increase the effectiveness of exposure therapy (van Minnen & Arntz, 2017).

Patients and therapists gathered the requisites based on the individual case conceptualization for the in vivo exposure sessions, for example trauma-related sounds (e.g. crying, yelling, sighing), pieces of clothing, pictures (e.g. the perpetrator or the house), physical poses, sexual toys and smells (e.g. perfume or the smell of alcohol).

Patients did not receive audio recordings of the sessions nor were they instructed to do homework because it was deemed unnecessary given the intensity of the treatment programme (with at least 4 hours of treatment per day for five consecutive days).

2.4.2. EMDR therapy

EMDR therapy was performed according to the manualized, eight-phase EMDR standard protocol for children and adolescents up to 18 years old (Beer, 2017). The flashforward protocol (Logie & de Jongh, 2014) was applied (with age-appropriate modifications) in case of anticipatory fear and avoidance behaviour and was used to target patients' most frightening future fantasies. EMDR therapy was performed with the use of rapid eye movement sets, offered by the hand of the therapist or by using a light bar. If and when required, therapists combined the employment of eye movements with extra tasks, for example, asking the patient to name the moving colours of the light bar, the use of sounds by using the headphone, pulsators or the so-called V-step in order to maximize the taxation of patients' working memory (De Jongh & Ten Broeke, 2019).

2.4.3. Treatment adherence

Outcome assessments were carried out by independent raters who had no therapeutic relationship with

the patients and had a master's degree in clinical psychology. They were thoroughly trained in conducting the interview. The supervisor was frequently present during the administration of the clinical interview. The assessments were carried out by independent assessors, which means that in some cases they performed multiple clinical interviews with the same participant. The assessors were aware of the measuring point (pre- and post-treatment or follow-up) during the patient's course of treatment.

Most of the therapists who provided the prolonged exposure sessions had a university degree in Applied Sciences and were trained in this therapy as co-workers registered by the Dutch Association of Behavioural and Cognitive Therapy. The co-workers performed the PE therapy under supervision of a cognitive-behavioural therapist. All EMDR therapists had a master's degree in Clinical Psychology and had been trained in EMDR therapy (minimum level II) by an accredited EMDR Europe trainer. To evaluate and optimize treatment adherence, supervision by an accredited EMDR consultant and accredited CBT consultant was provided daily during the intensive treatment period.

2.5. Data analyses

Frequency distributions for demographic and baseline clinical variables pre-treatment were calculated to describe sample characteristics. A one-way repeated measures ANOVA with a Huynh-Feldt correction using the CAPS-CA IV scores as the dependent variable was performed to determine treatment effects across treatment (pre- and post-treatment and at follow-up) for the intention-to-treat (ITT) sample, where last observations were carried forward. Next, differences between pre- to post-treatment and post-treatment to follow-up mean scores were tested using paired sampled t-tests ($N = 27$). Within effect sizes were calculated using Cohen's d . Clinically significant symptom change on the CAPS-CA IV was determined based upon the recommendation of Lindauer (2014) which requires a reduction of 15 points or more as a clinically significant response.

3. Results

3.1. Patient flow and sample characteristics

The characteristics of the treatment sample are presented in Table 1. In this study 27 patients (96.3%, $n = 26$, women) were included. They had a mean age of 16.1 years (range: 12–18 years; $SD = 1.3$). The majority had a very high PTSD severity score measured by the CAPS-CA IV (total severity score CAPS-CA IV ≥ 80 ; mean score 84.85). All patients had been exposed to one or more (interpersonal) traumatic

Table 1. Characteristics of the treatment sample ($N = 27$).

Variable	%	n
<i>Traumatic events</i>		
Domestic violence	51.9	14
Maltreatment	40.7	11
Sexual abuse	40.7	11
Traumatic loss and grief	7.4	2
Medical trauma	3.7	1
<i>Comorbid disorders</i>		
Mood disorders	44.4	12
Developmental disorders	29.6	8
Anxiety disorders	18.5	5
Personality disorders	18.5	5
Attachment disorders	7.4	2

experiences and displayed a high level of comorbidity; that is, 81.5% of the patients ($n = 22$) had one or more comorbid psychiatric disorders (mean = 2.22). None of the patients dropped out during treatment. However, three patients could not be reached for follow-up measurement. The average clinical admission time of the participants was 2.6 weeks (13 treatment days).

3.2. Effectiveness of treatment

The mean CAPS-CA IV total scores for this sample are presented in Figure 1. Results showed a significant decrease in CAPS-CA IV scores over time [ITT, $N = 27$; $F(1.64, 42.73) = 56.54$, $p < .001$; Cohen's $d = 1.39$]. Post-hoc analyses showed a statistically significant decrease in scores from pre-treatment to post-treatment [$N = 27$; $t(26) = 8.15$, $p < .001$; Cohen's $d = 1.45$] but not from post-treatment to follow-up [$n = 24$; $t(23) = 0.131$, $p = .45$; Cohen's $d = 0.01$].

The majority of the patients (81.5%, $n = 22$) showed a clinically meaningful response to treatment based upon the classification of Lindauer (Lindauer, 2014; Table 2). At the end of treatment 63.0% of the patients ($n = 17$) no longer fulfilled the diagnostic criteria of PTSD. None of the patients showed PTSD symptoms worsening based upon Lindauer's classification.

4. Discussion

As far as we are aware this is the first study that examined the effectiveness of an intensive inpatient trauma-focused treatment programme for adolescents combining two evidence-based therapies. The results showed that about 80% of the patients displayed a clinically meaningful response to their treatment, with an average duration of 2.6 weeks (13 days of treatment), whereas 63% no longer fulfilled the diagnostic criteria of PTSD at post-treatment. At follow-up, these results were maintained.

Regarding the effectiveness of the treatment, the results are in agreement with several other studies that have developed a similar kind of treatment programme for adults (e.g. Ehlers et al., 2014; Hendriks,

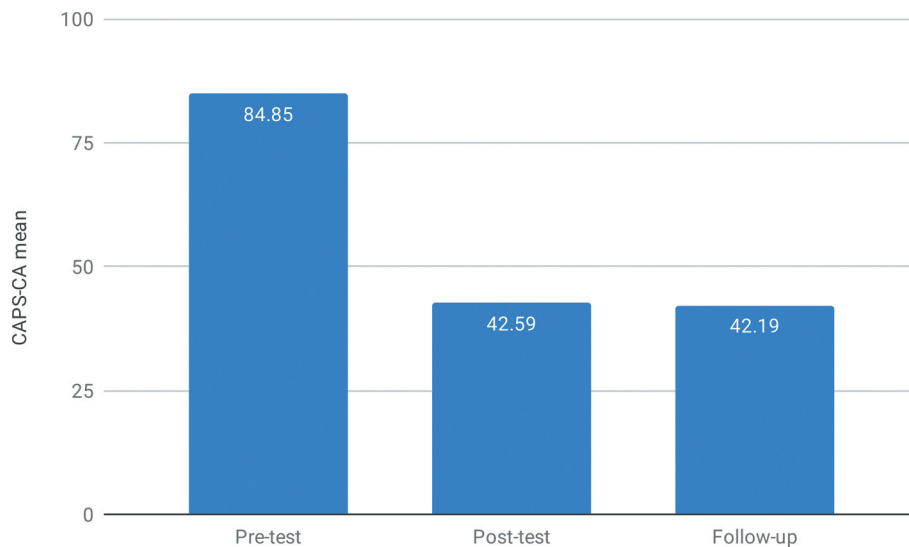


Figure 1. Total mean scores from the CAPS-CA IV (ITT; $N = 27$) at pre-test, post-test and at FU.

Table 2. CAPS-CA IV severity scores (Lindauer, 2014) at pre-treatment, post-treatment and at follow-up.

	Pre-treatment		Post-treatment		Three-month follow-up	
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
No PTSD Diagnosis	0	0	63	17	63	17
Light PTSD (0–19)	0	0	0	0	0	0
Mild PTSD (20–39)	0	0	3.7	1	3.7	1
Moderate PTSD (40–59)	14.8	4	3.7	1	7.4	2
Severe PTSD (60–79)	25.9	7	18.5	5	7.4	2
Very severe PTSD (80–136)	59.3	16	11.1	3	18.5	5

de Kleine, Broekman, Hendriks, & van Minnen, 2017, 2018; van Woudenberg et al., 2018; Zepeda Méndez et al., 2018; Zoellner et al., 2017). Yet, the current study had a higher percentage of patients who achieved diagnostic remission post-treatment (63% versus 40%) as compared to Hendriks' et al. (2017) study, the only other study that examined the effectiveness of an intensive prolonged exposure treatment programme for adolescents. The difference in terms of percentage 'loss of diagnosis' between both studies may be best explained by the differences in measurement instruments that were used. It is unclear whether the results of this study also would generalize to male adolescents, given the sample was predominantly female.

Furthermore, the results are supportive of our hypothesis that the retention of the participants in the present study would be high (i.e. zero drop-out rate during the treatment programme, albeit three patients were lost at the follow-up assessment). This is in sharp contrast with regular outpatient trauma-focused treatment programmes (Ragsdale et al., 2020; ranging from 30% to 62%). The high retention level may be due to the condensed format of frequently scheduled sessions conducted within a shorter time

frame (Mevisen et al., 2020; Ragsdale et al., 2020; Sciarrino et al., 2020; Silverstone et al., 2016), the clear view and perspective as to when treatment ends and the fact that the patients stayed in the clinic during the treatment days (van Woudenberg et al., 2018).

Yet, not every patient benefited from treatment. The patients that barely improved during the course of treatment experienced major distressing life events, for example, teenage pregnancy and change of their care home, which could have contributed to their inability to let go of their avoidant coping in order to avoid negative emotions/reduce stress in the short term. Similar to previous studies (Hendriks et al., 2018; van Woudenberg et al., 2018) in the present study, no adverse events occurred during the course of treatment.

It should be noted that our study was not intended to determine whether similar results would have been achieved when applying only one of the trauma-focused treatments. Previous studies showed (John-Baptiste Bastien et al., 2020; van Minnen et al., 2020; Sciarrino et al., 2020) that both treatments in an intensive form are equivalent in terms of effectiveness, in particular, the sequence is of importance. That is, that applying PE sessions prior to EMDR sessions is likely to result in a better treatment outcome than using the reverse order (van Minnen et al., 2020). Future research should investigate whether it is really necessary to combine evidence-based therapies and whether or not one would also be sufficient.

This study has several limitations that need to be considered. The main limitations are the lack of control group, randomization and a long-term follow-up. Also, the number of participants in this study was small and no multi-informant approach was used; the presence of a PTSD diagnosis and severity of PTSD symptomatology were the only outcome variables assessed. Furthermore, treatment fidelity was not evaluated and the independent

assessors were not blind to the time-point. Additional treatment and potential exposure to new traumatizing events ('revictimization') was not systematically recorded between post-treatment and follow-up.

Among the strengths of this study is the inclusion of help-seeking adolescents with severe PTSD symptoms and comorbid symptomatology exposed to a variety of traumatic events, thereby strengthening the external validity of the results. Other strengths are the use of a reliable and valid clinical diagnostic interview to assess the presence of a PTSD diagnostic status conducted by independent raters, the use of protocolized trauma interventions, the attendance of the supervisors at the daily multidisciplinary meetings, and supervised treatment sessions.

We assume that the stay in the clinic for a short period of time with the presence of practitioners with knowledge and skills in trauma-focused treatment, as well as administering a daily structure and social support (so-called contextual factors) had an additional value in contributing to the high retention rate.

In conclusion, the present results support the notion that an intensive inpatient treatment programme combining PE therapy, EMDR therapy and physical activity can be a safe and effective treatment for adolescents suffering from severe PTSD and multiple comorbidities after having experienced a range of chronic traumatic events. The fact that no dropout occurred suggests that implementing an intensive treatment format for adolescents with severe PTSD could increase completion of trauma treatment during a very important developmental stage of their lives.

Disclosure statement

C. de Roos receives income from a published book about EMDR therapy and training postdoctoral professionals in EMDR. A. de Jongh receives income from published books on EMDR therapy and for the training of postdoctoral professionals in this method. The other authors do not have competing interests.

Data availability statement

Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data are not available.

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