JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 5 • September 2026

MANAGING TRAUMATIC SYMPTOMS AMONG ADULTS BY USING EMDR THERAPY: AN EXPERIMENTAL STUDY OF WITHIN-TREATMENT CHANGE

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DOI: https://doi.org/10.5281/zenodo.22828497

Keywords
EMDR, trauma symptoms, growth curve modeling, age moderation, randomized controlled trial, Pakistan

Article History
Received: 01 June 2026
Accepted: 23 August 2026
Published: 08 September 2026

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Abstract

Eye Movement Desensitization and Reprocessing (EMDR) therapy is an extensively validated trauma treatment, yet the shape and consistency of within-treatment symptom change, and whether this change is moderated by participant age, remain underexamined using growth curve methodology. This study examined trauma symptom change across an eight-session EMDR protocol among 40 Pakistani adults with clinically significant trauma symptoms, and tested whether this change was moderated by participant age group. Participants completed the Trauma Symptom Checklist-40 (TSC-40) at five occasions (T1 baseline through T5 three-month follow-up). Repeated-measures multivariate analysis of variance indicated a significant multivariate effect of time across the six TSC-40 symptom domains, Wilks' Λ = .500, $F(24, 629.16) = 5.76$, $p < .001$, with significant univariate declines for all seven outcomes (Total Traumatic Symptoms and six subscales; all $p < .001$, $\eta^2 = .127$ to .452). Linear mixed-effects growth curve models confirmed significant linear decline for every outcome (e.g., Total Traumatic Symptoms: $B = -5.17$, $SE = 0.53$, $t = -9.85$, $p < .001$), with retention of 90% at three-month follow-up. Neither the main effect of age group nor the Time × Age Group interaction reached significance for any outcome, and post hoc pairwise comparisons of age-group slopes were uniformly non-significant, indicating that symptom decline during treatment was consistent across the 18-to-65 adult age range. These findings demonstrate that EMDR produces robust, statistically significant, and age-invariant trauma symptom reduction across the course of treatment, supporting its applicability as a uniform protocol across

INTRODUCTION

An estimated 70% of the global population are exposed to potentially traumatic events at least during their lifetime, and although most trauma-exposed people do not meet the criteria for a diagnosable Post-Traumatic Stress Disorder, many have clinically significant trauma-related symptomatology that can be chronic (Koenen et

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al., 2017). These symptoms span the cognitive, affective, somatic, and interpersonal areas, including the intrusive and avoidance symptoms that are the key components of a formal diagnosis of PTSD as well as dissociation, sleep disturbance, and sexual dysfunction, which may all disrupt functioning and occur outside the context of a formal diagnosis of PTSD (Briere & Runtz, 1989). Thus, the availability of evidence-based psychological interventions that can achieve rapid, large, and lasting decreases in this entire symptom spectrum is a public health priority, especially in environments where trauma exposure is especially high and where treatment resources are especially limited.

Eye Movement Desensitization and Reprocessing (EMDR) therapy is one of the most widely studied psychotherapeutic interventions for trauma internationally, with network meta-analytic evidence showing that it is as effective as trauma-focused Cognitive Behavioral Therapy (CBT) and more effective than Waitlist or Usual Care conditions in adult trauma populations (Mavranezouli et al., 2020). EMDR was developed by Shapiro (1989, 2018) and is based on the Adaptive Information Processing (AIP) model, which posits that traumatic memories can be stored in an adaptive manner or in a dysfunctional form. EMDR is an eight phase protocol that includes bilateral stimulation and is thought to allow the adaptive reprocessing of traumatic material to diminish the capacity to produce current distress.

The need for controlled evidence of the effectiveness of EMDR is especially relevant in Pakistan as a convergence of interpersonal violence, conflict-related exposure, and the frequent occurrence of natural disasters has created a situation of chronic cumulative trauma exposure in the population (Husain et al., 2020; Melillo et al., 2025). Access to structured trauma focused psychotherapy in Pakistan is still very limited due to a scarcity of trained mental health professionals and the existing treatment infrastructure which are more geared towards pharmacological treatment of trauma related presentations than psychotherapeutic treatments (Husain et al., 2020). In Pakistan, the use of EMDR has been limited to pediatric and school-based disaster-exposed group protocols, while the eight-phase adult protocol as evaluated in the present study has not been empirically tested in this population before the present research.

In spite of this strong evidence for effectiveness, the current EMDR literature has been largely based on the simple pre-post or pre-post-follow-up design, which yields limited information on the nature of change over the course of treatment (whether it is linear or curvilinear), whether or not there is meaningful individual variability in treatment effect, or whether specific demographic subgroups respond differently, and if so, whether at different rates (Curran et al., 2010). Linear mixed-effects growth curve modeling offers a methodologically superior alternative for addressing these questions, since, unlike repeated-measures analysis of variance, it explicitly models the within-person correlation inherent in repeated assessment of the same individuals and accommodates unbalanced data arising from attrition without requiring complete-case deletion (Singer & Willett, 2003). Despite these advantages, published applications of growth curve modeling to characterize within-treatment trajectories during EMDR specifically remain scarce.

The broader psychotherapy outcome literature, drawing predominantly on cognitive-behavioral and counseling interventions for depression and anxiety, has used growth curve and related latent trajectory methods considerably more extensively than the EMDR literature specifically. This literature has generally found that symptom change across a course of psychotherapy is not uniform, but instead follows one of several distinct trajectory shapes: a large-scale latent class growth analysis of over 4,000 patients receiving psychological therapy for depression and anxiety identified four distinct depressive and five distinct anxious symptom trajectory classes, with most classes distinguishable by the third treatment session, though a subset of depressive trajectories

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showed limited change until the sixth session followed by more rapid improvement thereafter (Saunders et al., 2019). This finding, that a meaningful subset of patients are late rather than early responders, carries a specific methodological caution for treatment monitoring: relying on early-session change alone to judge whether a patient is responding to treatment risks prematurely discontinuing or altering treatment for patients who would otherwise show substantial improvement later in the treatment course. Whether EMDR's within-treatment trajectory follows a similarly heterogeneous, late-responder-inclusive pattern, or a more uniform trajectory across the sample, has not been directly tested using comparable growth-curve methodology.

A further underexamined question concerns whether EMDR's treatment effect is moderated by client age. Broader post-trauma adjustment research has identified age as one of several demographic predictors of recovery trajectory following trauma exposure more generally (Galatzer-Levy et al., 2018), and a systematic review and meta-analysis of PTSD risk factors identified younger age at trauma exposure as a modest but reliably replicated predictor of subsequent symptom severity (Ozer et al., 2003). However, whether this general age-related variability in natural post-trauma adjustment extends to the rate of response to structured, therapist-delivered reprocessing treatment specifically has not been directly tested using a design capable of modeling individual trajectory shape.

This gap carries direct clinical significance: if EMDR's treatment effect varies meaningfully by client age, clinicians might reasonably consider age-adapted pacing or session structuring; if the effect is uniform across the adult age range, EMDR's standard protocol can be applied with equal confidence across ages without modification. The present study addressed this gap by examining, within a sample of Pakistani adults receiving an eight-session EMDR protocol, (a) the overall shape and magnitude of trauma symptom change across the course of treatment, and (b) whether this rate of change is moderated by participant age group.

Research Gap

Three specific gaps motivate the present study. First, few published EMDR trials have modeled within-treatment change using linear mixed-effects growth curve methodology capable of characterizing both the average trajectory and individual variability around it, relying instead on simpler repeated-measures or pre-post comparison frameworks (Curran et al., 2010). Second, the specific question of whether EMDR's within-treatment effect is moderated by client age has received minimal direct empirical attention using a design and analytic approach capable of testing this moderation formally, as opposed to inferring it from broader, treatment-non-specific trauma adjustment literature. Third, controlled evaluations of EMDR's standard adult protocol remain scarce within Pakistani and, more broadly, South Asian populations, leaving open whether the within-treatment change patterns established primarily in Western samples generalize to this cultural and clinical context.

Aim of the Study

This study aimed to examine trauma symptom change across the course of an eight-session EMDR protocol among Pakistani adults with clinically significant trauma symptoms, and to test whether this change was moderated by participant age group.

Objectives

1. To examine change in trauma symptoms (total score and six subscale scores) among EMDR participants across the course of treatment (T1 baseline through T5 follow-up).
2. To examine whether the rate of change in trauma symptoms during treatment is moderated by participant age group.

Hypotheses

H1: EMDR participants will demonstrate a statistically significant decrease in trauma

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symptoms across the course of treatment (T1 baseline through T5 follow-up).

H2: The rate of trauma symptom reduction during EMDR treatment will not differ significantly by participant age group.

Method

Research Design

This study employed a single-group, repeated-measures experimental design, examining trauma symptom change across five assessment occasions among adults receiving a structured eight-session EMDR protocol. This design formed the experimental (EMDR) arm of a larger two-arm randomized controlled trial; only within-group change among EMDR recipients is analyzed here, without reference to the trial's treatment-as-usual control condition.

Participants

Participants were 40 adults aged 18 to 65 years with clinically significant trauma symptoms, recruited from outpatient psychology clinics and community health settings in Bahawalpur, Punjab, Pakistan, and randomly allocated to the EMDR condition of the parent trial. The total scores of the Trauma Symptom Checklist-40 (TSC-40) for eligible participants were at or above a 21 score at the screening and confirmed by the structured clinical eligibility interview and written informed consent.

Sample Size

For the parent trial, sample size was determined a priori using the program G*Power version 3.1 (Faul et al., 2007) with a medium effect size (f = 0.25) for the primary between-group comparison, power of 80%, alpha level of 5%, and the within-person correlation of ρ = 0.50 across repeated assessments, resulting in a minimum requirement of 32 participants per arm, with an expected 20% attrition rate accounted for by enrolling 40.

Inclusion and Exclusion Criteria

Inclusion criteria were: (a) aged 18 to 65 years; (b) at least one qualifying traumatic event exposure; (c) TSC-40 total score ≥ 21; (d) sufficient literacy in English; and (e) willingness to attend eight weekly sessions. Exclusion criteria were: (a) active psychosis or a current manic episode; (b) cognitive impairment precluding informed consent; (c) active substance dependence as the primary presenting concern; (d) concurrent enrollment in another structured trauma-focused psychotherapy; and (e) imminent risk to self or others requiring inpatient psychiatric care.

Intervention

Participants received the complete eight-phase EMDR protocol (Shapiro, 2018) across eight weekly individual sessions of 60 to 90 minutes, delivered by EMDRIA Basic Training-certified clinical psychologists receiving ongoing EMDRIA-certified consultation. Phase 1 (History Taking) and Phase 2 (Preparation, including Safe Place and Container exercises) were completed across Sessions 1 and 2; Phases 3 through 7 (Assessment, Desensitization, Installation, Body Scan, Closure) were applied iteratively to successive target memories across Sessions 3 through 8, following a three-pronged sequence addressing past memories, present triggers, and a future template; and Phase 8 (Reevaluation) opened every session from Session 2 onward. Treatment fidelity was monitored using the EMDR Fidelity Rating Scale (Korn et al., 2018) applied to 20% of randomly selected session recordings by an independent, reliability-trained rater.

Measures

Trauma symptoms were assessed using the Trauma Symptom Checklist-40 (TSC-40; Briere & Runtz, 1989), a 40-item self-report measure yielding a total score and six subscale scores: Anxiety, Depression, Dissociation, Sexual Abuse Trauma Index (SATI), Sleep Disturbance, and Sexual Problems. The TSC-40 was administered at five times: T1 (baseline, before Session 1); T2 (within 48 hours after Session 3); T3 (within 48 hours after Session 5); T4 (post-test, within 1 week after Session 8); and T5 (3-month follow-up).

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Procedure

After eligibility and baseline assessment, participants were given the 8-session EMDR protocol outlined above, and were re-administered the TSC-40 at T2, T3, T4 and T5, as outlined above. Age of the participants at the baseline was recorded and divided into 5 age groups for moderation analysis (18-25, 26-35, 36-45, 46-55, 56-65).

Ethical Considerations

The Institutional Review Board (IRB) of Islamia University of Bahawalpur approved the study and it was conducted in accordance with the ethical principles of the American Psychological Association (2017) and the Declaration of Helsinki (World Medical Association, 2018). Those who experienced a moderate to high level of distress in one or more session were provided with supportive intervention immediately and, where indicated, psychiatric evaluation – and all participants had access to a 24-hour safety contact.

Data Analysis

Differential attrition (e.g., if patients with worsening symptoms were more likely to drop out of the treatment than others) was therefore examined first via descriptive statistics, because if not taken into account alongside the substantive findings, estimates of average change associated with the treatment could be biased. A repeated-measures multivariate analysis of variance (MANOVA) tested the omnibus effect of Time across the six TSC-40 subscales jointly, followed by univariate repeated-measures ANOVAs for each of the seven outcomes (Total score and six subscales) to test Hypothesis 1. Reporting the multivariate test before the univariate follow-up tests protected against the inflated Type I error that would otherwise accumulate across seven correlated univariate significance tests conducted at a nominal $\alpha = .05$. To test Hypothesis 2, and to model within-treatment trajectory shape more precisely than the ANOVA framework permits, a linear mixed-effects growth curve model was fitted for each of the seven outcomes using the lme4 and lmerTest packages in R (Bates et al., 2015; Kuznetsova et al., 2017), specifying Time (continuous, T1–T5), Age Group, and their interaction as fixed effects, with a random intercept for participant. A fuller model additionally specifying a random slope for Time was compared to the random-intercept-only model using AIC, BIC, and a likelihood ratio test; where the random-slope specification produced a singular fit, the simpler random-intercept-only model was retained (Matuschek et al., 2017). Denominator degrees of freedom and p-values were estimated using Satterthwaite's method, and post hoc pairwise comparisons of age-group slopes were conducted using Tukey-adjusted contrasts (Lenth, 2024). All analyses were conducted in R version 4.3 (R Core Team, 2024), with significance set at $\alpha = .05$.

Results

Sample Retention and Descriptive Change

Retention was high across the treatment course: all 40 participants were retained through T2, declining to 37 (92.5%) by T3 and T4 following three withdrawals, and to 36 (90.0%) at the three-month T5 follow-up following one further withdrawal. This retention pattern is reported prior to the substantive outcome analyses because differential attrition, for example, if participants with worsening symptoms were disproportionately likely to withdraw, could otherwise bias estimates of average treatment-related change; no systematic pattern distinguishing withdrawing from retained participants was observed on baseline symptom severity, gender, or age group in the present sample, providing some reassurance against this specific threat to validity, though the modest number of withdrawals limits the power of this comparison. Table 1 presents descriptive statistics for all seven trauma symptom outcomes at each assessment occasion. All outcomes declined steadily from baseline through post-test (T1–T4), with the steepest decline occurring between T3 and T4; a small rebound was observed between T4 and T5 for several outcomes, consistent with a pattern of continued but decelerating

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improvement following the conclusion of active treatment.

Table 1: Descriptive Statistics for Trauma Symptom Outcomes Across Treatment (EMDR Group, N = 40 at T1–T2, N = 37 at T3–T4, N = 36 at T5)

Outcome	T1 M (SD)	T2 M (SD)	T3 M (SD)	T4 M (SD)	T5 M (SD)
Total Traumatic Symptoms	49.37 (7.54)	45.74 (9.00)	40.97 (8.61)	30.24 (9.10)	31.08 (8.63)
Anxiety	12.58 (2.07)	11.68 (2.81)	10.11 (2.76)	7.27 (2.62)	7.69 (2.59)
Depression	12.53 (2.36)	11.08 (2.82)	10.54 (2.28)	7.30 (2.37)	7.67 (2.60)
Dissociation	6.05 (1.65)	5.63 (1.85)	5.00 (1.73)	3.73 (2.31)	3.97 (1.61)
Sexual Abuse Trauma Index	7.13 (2.19)	7.53 (2.12)	6.14 (2.10)	4.57 (2.19)	5.08 (2.36)
Sleep Disturbance	6.30 (1.86)	5.85 (2.09)	4.97 (1.83)	3.97 (1.69)	3.72 (1.68)
Sexual Problems	4.68 (1.83)	4.33 (1.64)	3.86 (1.97)	3.08 (1.57)	3.08 (1.50)

Multivariate and Univariate Tests of Change (Hypothesis 1)

A repeated-measures MANOVA testing the omnibus effect of Time across the six TSC-40 subscale scores jointly was significant, Wilks' Λ = .500, $F(24, 629.16) = 5.76$, $p < .001$, $\eta^2 = .159$, confirming a significant multivariate change in trauma symptom profile across treatment before univariate follow-up tests were examined, protecting against inflated Type I error. Univariate repeated-measures ANOVAs confirmed a significant effect of Time for every outcome (all $p < .001$), with effect sizes ranging from $\eta^2 = .127$ (Sexual Problems) to $\eta^2 = .452$ (Total Traumatic Symptoms), reported alongside the corresponding growth curve results for each outcome below. These results provide strong support for Hypothesis 1.

Growth Curve Models: Fixed Effects, Random Effects, and Age Group Moderation (Hypotheses 1 and 2)

For each of the seven trauma symptom outcomes, a linear mixed-effects growth curve model was fitted specifying Time, Age Group (reference category 18–25), and their interaction as fixed effects, with a random intercept for participant; the random-intercept-plus-slope specification produced a singular fit for every outcome and was therefore not retained (Matuschek et al., 2017). Tables 2 through 8 present, for each outcome in turn, the complete fixed-effects estimates, the random-effects variance components and model fit indices, and the Tukey-adjusted post hoc pairwise comparisons of age-group slopes, followed by the corresponding individual and age-group-mean trajectory figure.

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Total Traumatic Symptoms

Table 2: Growth Curve Model Results: Total Traumatic Symptoms (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	55.83	2.58	73.87	21.64	< .001**
Time (linear slope)	-5.17	0.53	149.25	-9.85	< .001**
Age Group: 26–35	-2.01	3.91	73.51	-0.51	.609
Age Group: 36–45	1.24	5.29	72.54	0.23	.816
Age Group: 46–55	0.43	3.90	73.38	0.11	.913
Age Group: 56–65	-3.52	5.92	72.46	-0.60	.554
Time × Age Group: 26–35	-0.03	0.79	148.45	-0.04	.965
Time × Age Group: 36–45	-0.46	1.03	146.22	-0.45	.652
Time × Age Group: 46–55	-0.40	0.78	147.22	-0.51	.608
Time × Age Group: 56–65	-0.38	1.15	146.01	-0.33	.743
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	50.94	7.14			
Residual Variance	31.13	5.58			
Log-Likelihood	-621.67	—			
AIC	1267.35	—			
BIC	1306.31	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	0.03	0.79		0.04	1.000
18–25 vs. 36–45	0.46	1.03		0.45	.991
18–25 vs. 46–55	0.40	0.78		0.51	.986
18–25 vs. 56–65	0.38	1.15		0.33	.997
26–35 vs. 36–45	0.43	1.06		0.41	.994
26–35 vs. 46–55	0.36	0.82		0.45	.992

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26–35 vs. 56–65	0.34	1.17	0.29	.998
36–45 vs. 46–55	-0.07	1.05	-0.06	1.000
36–45 vs. 56–65	-0.09	1.35	-0.06	1.000
46–55 vs. 56–65	-0.02	1.17	-0.02	1.000

*Note. $F(4, 185)$, p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Total Traumatic Symptoms: $F = 38.15$, $p < .001$, $\eta^2 = .452$. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *$p < .05$, **$p < .01$.*

Total Traumatic Symptoms declined significantly across treatment, B = -5.17, SE = 0.53, t = -9.85, p < .001. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .554), and no post hoc pairwise comparison of age-group slopes reached significance (all p ≥ .986), confirming a uniform rate of overall symptom decline across the adult age range studied.

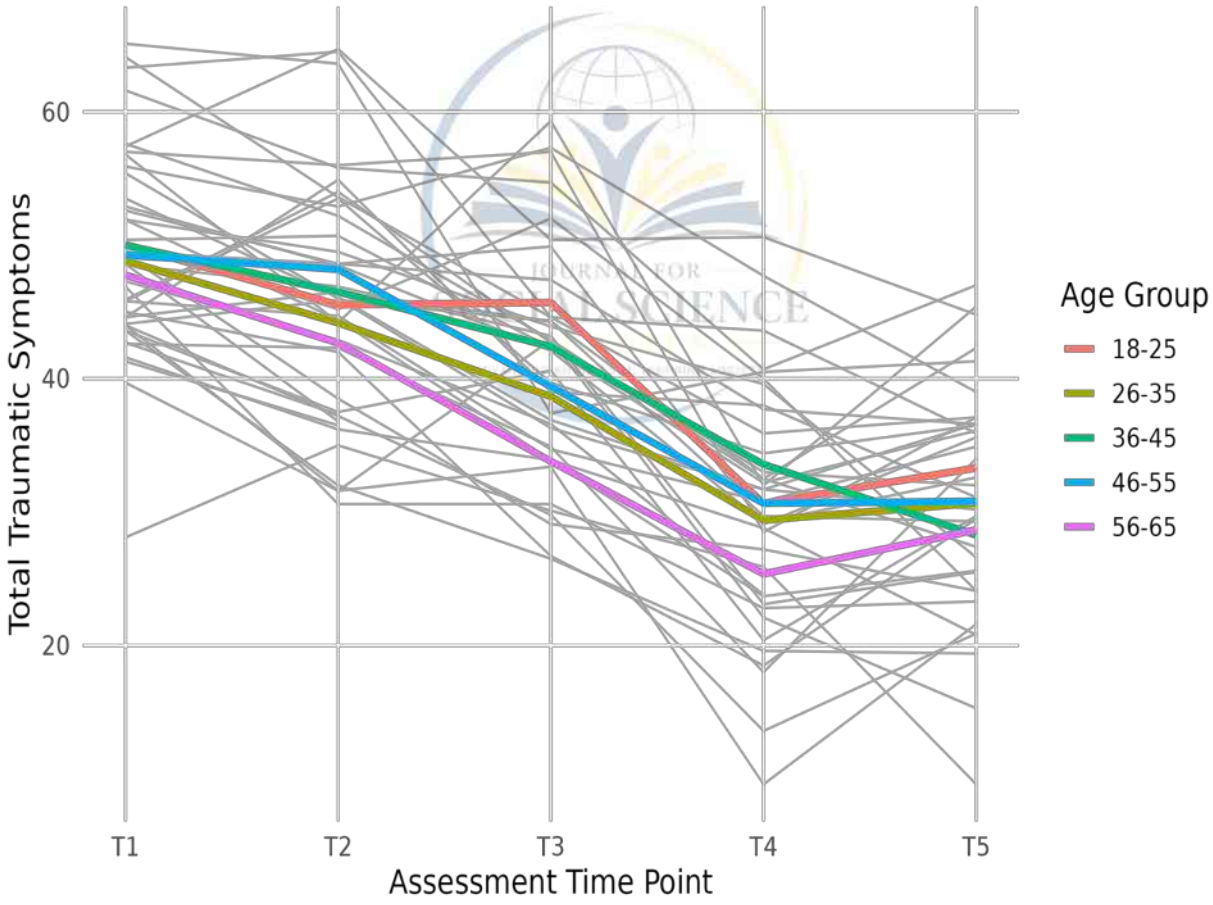

Figure 1. Individual and Age-Group-Mean Trajectories: Total Traumatic Symptoms (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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Anxiety

Table 3: Growth Curve Model Results: Anxiety (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	13.94	0.78	116.67	17.89	< .001**
Time (linear slope)	-1.37	0.20	151.87	-6.95	< .001**
Age Group: 26–35	-0.84	1.18	116.13	-0.71	.479
Age Group: 36–45	1.21	1.59	114.66	0.76	.450
Age Group: 46–55	1.08	1.18	115.96	0.92	.360
Age Group: 56–65	0.49	1.78	114.53	0.28	.783
Time × Age Group: 26–35	0.25	0.29	150.54	0.84	.404
Time × Age Group: 36–45	-0.28	0.39	146.86	-0.74	.463
Time × Age Group: 46–55	-0.33	0.29	148.60	-1.14	.257
Time × Age Group: 56–65	-0.47	0.43	146.51	-1.08	.280
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	2.85	1.69			
Residual Variance	4.42	2.10			
Log-Likelihood	-432.73	—			
AIC	889.47	—			
BIC	928.43	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	-0.25	0.29		-0.84	.919
18–25 vs. 36–45	0.28	0.39		0.74	.948
18–25 vs. 46–55	0.33	0.29		1.14	.786
18–25 vs. 56–65	0.47	0.43		1.08	.815
26–35 vs. 36–45	0.53	0.40		1.33	.671
26–35 vs. 46–55	0.58	0.31		1.88	.331
26–35 vs. 56–65	0.71	0.44		1.62	.490

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36–45 vs. 46–55	0.05	0.40	0.12	1.000
36–45 vs. 56–65	0.18	0.51	0.36	.996
46–55 vs. 56–65	0.14	0.44	0.31	.998

*Note. F(4, 185), p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Anxiety: F = 31.67, p < .001, η^2 = .406. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *p < .05, **p < .01.*

Anxiety declined significantly across treatment, B = -1.37, SE = 0.20, t = -6.95, p < .001. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .257), and no post hoc pairwise comparison reached significance (all p ≥ .331).

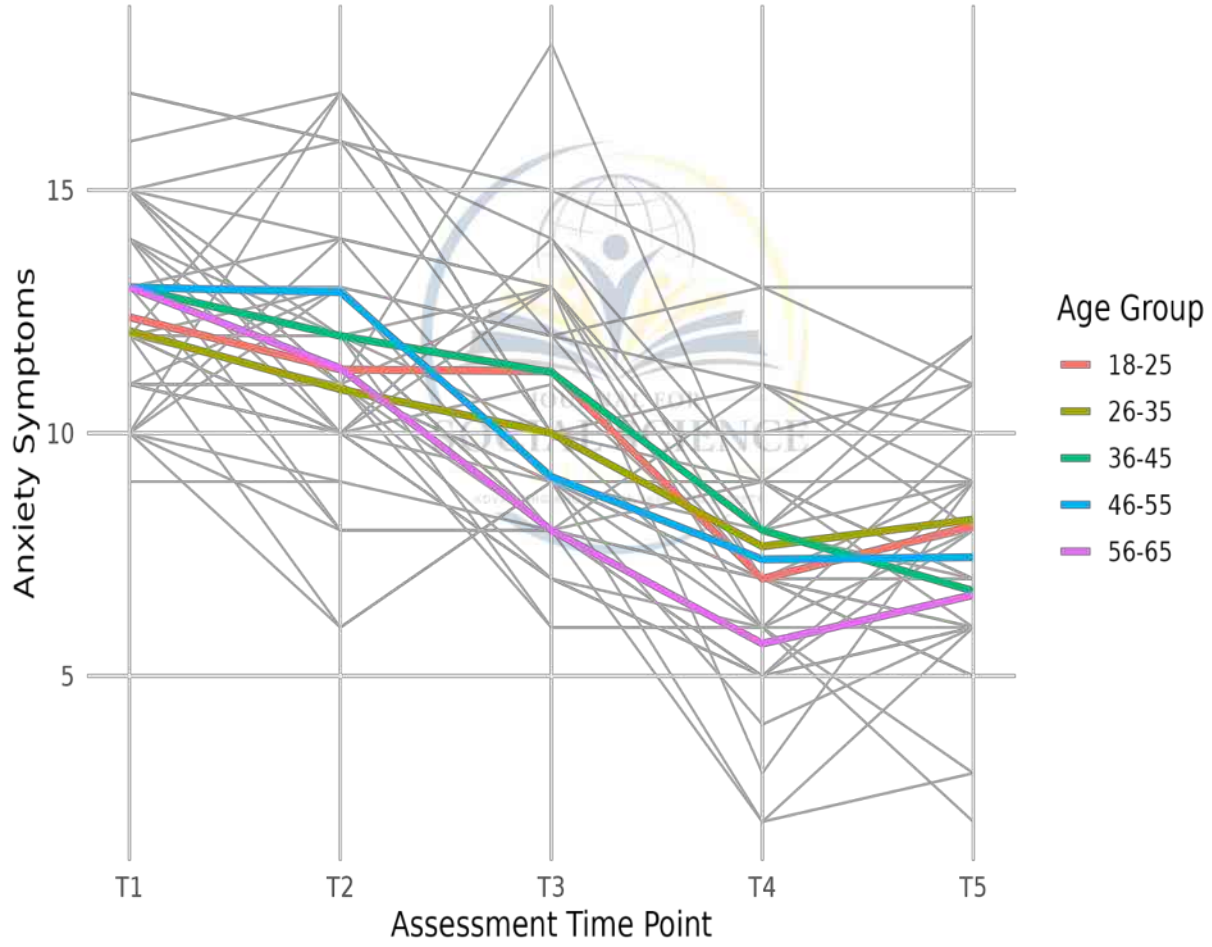

Figure 2. Individual and Age-Group-Mean Trajectories: Anxiety (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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Depression

Table 4: Growth Curve Model Results: Depression (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	14.33	0.75	109.80	19.00	< .001**
Time (linear slope)	-1.44	0.19	151.60	-7.75	< .001**
Age Group: 26–35	-1.42	1.14	109.26	-1.25	.215
Age Group: 36–45	0.60	1.54	107.81	0.39	.699
Age Group: 46–55	-0.13	1.14	109.09	-0.11	.911
Age Group: 56–65	-1.13	1.73	107.69	-0.65	.515
Time × Age Group: 26–35	0.20	0.28	150.36	0.73	.467
Time × Age Group: 36–45	0.01	0.36	146.90	0.04	.971
Time × Age Group: 46–55	-0.03	0.28	148.51	-0.11	.910
Time × Age Group: 56–65	0.10	0.41	146.56	0.26	.797
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	2.90	1.70			
Residual Variance	3.93	1.98			
Log-Likelihood	-423.93	—			
AIC	871.87	—			
BIC	910.83	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	-0.20	0.28		-0.73	.950
18–25 vs. 36–45	-0.01	0.36		-0.04	1.000
18–25 vs. 46–55	0.03	0.28		0.11	1.000
18–25 vs. 56–65	-0.10	0.41		-0.26	.999
26–35 vs. 36–45	0.19	0.38		0.50	.987

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26–35 vs. 46–55	0.23	0.29	0.81	.928
26–35 vs. 56–65	0.10	0.42	0.23	.999
36–45 vs. 46–55	0.04	0.37	0.12	1.000
36–45 vs. 56–65	-0.09	0.48	-0.19	1.000
46–55 vs. 56–65	-0.14	0.42	-0.33	.997

*Note. $F(4, 185)$, p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Depression: $F = 31.12$, $p < .001$, $\eta^2 = .402$. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *$p < .05$, **$p < .01$.*

Depression declined significantly across treatment, B = -1.44, SE = 0.19, t = -7.75, p < .001. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .515), and no post hoc pairwise comparison reached significance (all p ≥ .928).

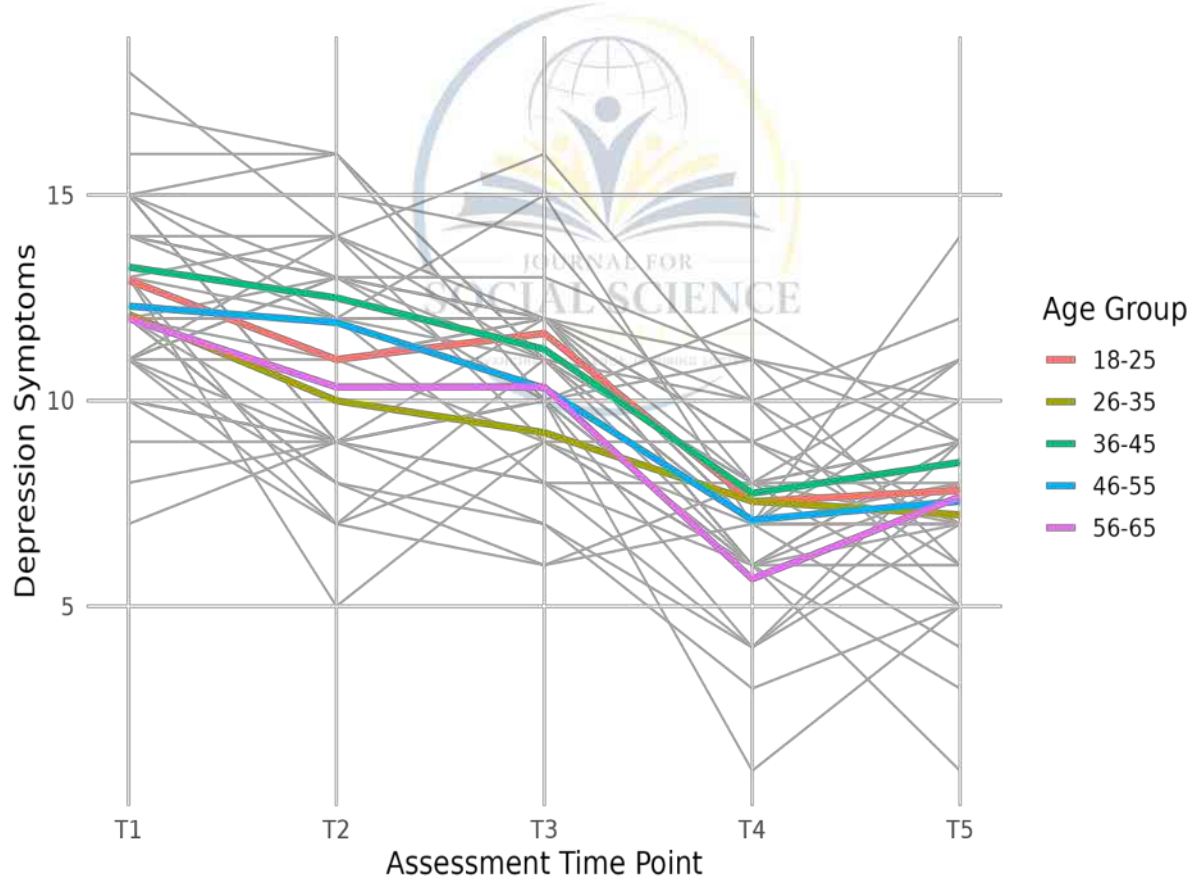

Figure 3. Individual and Age-Group-Mean Trajectories: Depression (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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Dissociation

Table 5: Growth Curve Model Results: Dissociation (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	6.62	0.54	159.23	12.15	< .001**
Time (linear slope)	-0.47	0.15	154.31	-3.05	.003**
Age Group: 26–35	0.08	0.82	158.90	0.10	.919
Age Group: 36–45	-0.10	1.11	157.93	-0.09	.929
Age Group: 46–55	0.39	0.82	158.76	0.47	.638
Age Group: 56–65	-0.49	1.24	157.84	-0.39	.694
Time × Age Group: 26–35	-0.27	0.23	152.61	-1.15	.252
Time × Age Group: 36–45	0.05	0.31	147.97	0.15	.879
Time × Age Group: 46–55	-0.24	0.23	150.35	-1.04	.301
Time × Age Group: 56–65	-0.20	0.34	147.53	-0.57	.568
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	0.70	0.83			
Residual Variance	2.78	1.67			
Log-Likelihood	-380.25	—			
AIC	784.50	—			
BIC	823.47	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	0.27	0.23		1.15	.780
18–25 vs. 36–45	-0.05	0.31		-0.15	1.000
18–25 vs. 46–55	0.24	0.23		1.04	.837
18–25 vs. 56–65	0.20	0.34		0.57	.979
26–35 vs. 36–45	-0.31	0.32		-0.99	.858
26–35 vs. 46–55	-0.03	0.24		-0.11	1.000
26–35 vs. 56–65	-0.07	0.35		-0.20	1.000

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36–45 vs. 46–55	0.29	0.31	0.91	.893
36–45 vs. 56–65	0.24	0.40	0.60	.975
46–55 vs. 56–65	-0.04	0.35	-0.13	1.000

*Note. $F(4, 185)$, p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Dissociation: $F = 11.46$, $p < .001$, $\eta^2 = .199$. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *p < .05, **p < .01.*

Dissociation declined significantly across treatment, B = -0.47, SE = 0.15, t = -3.05, p = .003. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .252), and no post hoc pairwise comparison reached significance (all p ≥ .780).

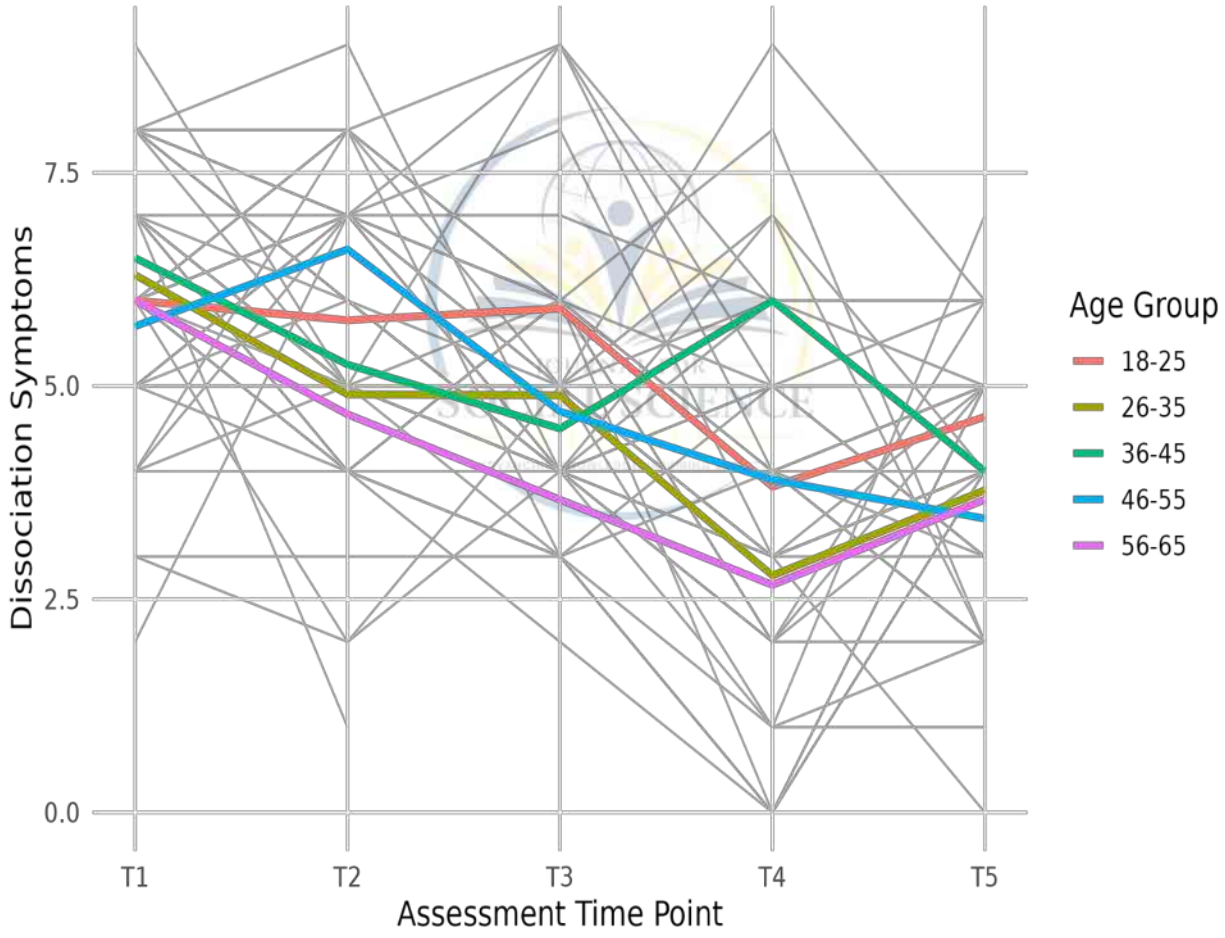

Figure 4. Individual and Age-Group-Mean Trajectories: Dissociation (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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An International Peer-Reviewed Open Access Journal
ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
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Sexual Abuse Trauma Index

Table 6: Growth Curve Model Results: Sexual Abuse Trauma Index (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	8.64	0.66	157.18	13.15	< .001**
Time (linear slope)	-0.82	0.19	154.64	-4.45	< .001**
Age Group: 26–35	-0.11	0.99	156.82	-0.11	.910
Age Group: 36–45	-0.77	1.34	155.80	-0.57	.567
Age Group: 46–55	-0.72	0.99	156.69	-0.73	.466
Age Group: 56–65	-1.91	1.50	155.71	-1.27	.205
Time × Age Group: 26–35	0.24	0.28	152.99	0.85	.397
Time × Age Group: 36–45	0.20	0.37	148.46	0.54	.588
Time × Age Group: 46–55	0.04	0.28	150.76	0.16	.873
Time × Age Group: 56–65	0.36	0.41	148.03	0.87	.384
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	1.08	1.04			
Residual Variance	3.99	2.00			
Log-Likelihood	-413.40	—			
AIC	850.80	—			
BIC	889.76	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	-0.24	0.28		-0.85	.915
18–25 vs. 36–45	-0.20	0.37		-0.54	.983
18–25 vs. 46–55	-0.04	0.28		-0.16	1.000
18–25 vs. 56–65	-0.36	0.41		-0.87	.907
26–35 vs. 36–45	0.04	0.38		0.10	1.000
26–35 vs. 46–55	0.19	0.29		0.66	.965
26–35 vs. 56–65	-0.12	0.42		-0.29	.998

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36–45 vs. 46–55	0.15	0.38	0.41	.994
36–45 vs. 56–65	-0.16	0.48	-0.33	.997
46–55 vs. 56–65	-0.31	0.42	-0.75	.945

*Note. F(4, 185), p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Sexual Abuse Trauma Index: F = 12.87, p < .001, η^2 = .218. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *p < .05, **p < .01.*

Sexual Abuse Trauma Index declined significantly across treatment, B = -0.82, SE = 0.19, t = -4.45, p < .001. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .205), and no post hoc pairwise comparison reached significance (all p ≥ .907).

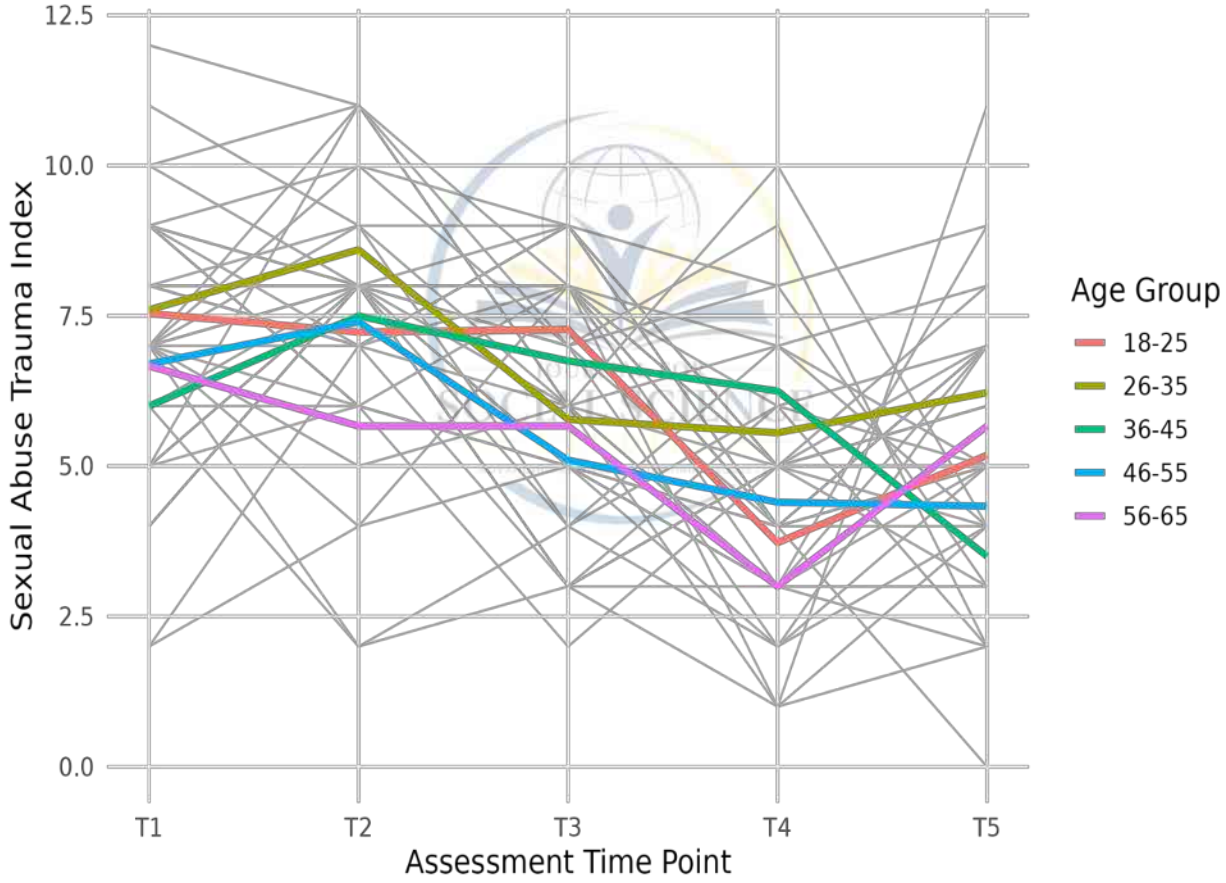

Figure 5. Individual and Age-Group-Mean Trajectories: Sexual Abuse Trauma Index (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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An International Peer-Reviewed Open Access Journal
ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
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Sleep Disturbance

Table 7: Growth Curve Model Results: Sleep Disturbance (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	6.51	0.54	168.25	12.03	< .001**
Time (linear slope)	-0.48	0.16	155.39	-3.04	.003**
Age Group: 26–35	-0.01	0.82	168.03	-0.01	.990
Age Group: 36–45	1.77	1.10	167.35	1.60	.111
Age Group: 46–55	1.16	0.82	167.91	1.42	.159
Age Group: 56–65	1.36	1.23	167.30	1.10	.273
Time × Age Group: 26–35	-0.10	0.24	153.65	-0.41	.685
Time × Age Group: 36–45	-0.45	0.31	148.94	-1.43	.154
Time × Age Group: 46–55	-0.47	0.23	151.43	-2.00	.047*
Time × Age Group: 56–65	-0.52	0.35	148.49	-1.50	.136
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	0.51	0.72			
Residual Variance	2.89	1.70			
Log-Likelihood	-380.87	—			
AIC	785.73	—			
BIC	824.70	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	0.10	0.24		0.41	.994
18–25 vs. 36–45	0.45	0.31		1.43	.608
18–25 vs. 46–55	0.47	0.23		2.00	.272
18–25 vs. 56–65	0.52	0.35		1.50	.566
26–35 vs. 36–45	0.35	0.32		1.09	.811
26–35 vs. 46–55	0.37	0.25		1.51	.559
26–35 vs. 56–65	0.43	0.36		1.19	.756

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36–45 vs. 46–55	0.02	0.32	0.07	1.000
36–45 vs. 56–65	0.07	0.41	0.18	1.000
46–55 vs. 56–65	0.05	0.36	0.15	1.000

*Note. F(4, 185), p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Sleep Disturbance: F = 14.30, p < .001, η^2 = .236. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *p < .05, **p < .01.*

Sleep Disturbance declined significantly across treatment, B = -0.48, SE = 0.16, t = -3.04, p = .003. The omnibus Age Group main effect was non-significant (all four dummy-coded contrasts p ≥ .111). One of the four Time × Age Group interaction terms, contrasting the 46–55 age band against the 18–25 reference group, reached nominal significance before correction (B = -0.47, SE = 0.23, t = -2.00, p = .047); however, the corresponding Tukey-adjusted post hoc pairwise comparison of this same slope contrast was non-significant (p = .272), and none of the remaining nine pairwise contrasts approached significance (all p ≥ .559). Given that four Time × Age Group interaction terms were tested for this outcome alone, and 28 such terms were tested cumulatively across all seven outcomes, a single nominally significant coefficient at p = .047 is consistent with the rate of false-positive findings expected by chance under a true null hypothesis of no age moderation, and this isolated result should not be interpreted as evidence of genuine age-moderated treatment response for Sleep Disturbance specifically; this pattern is addressed further in the Discussion.

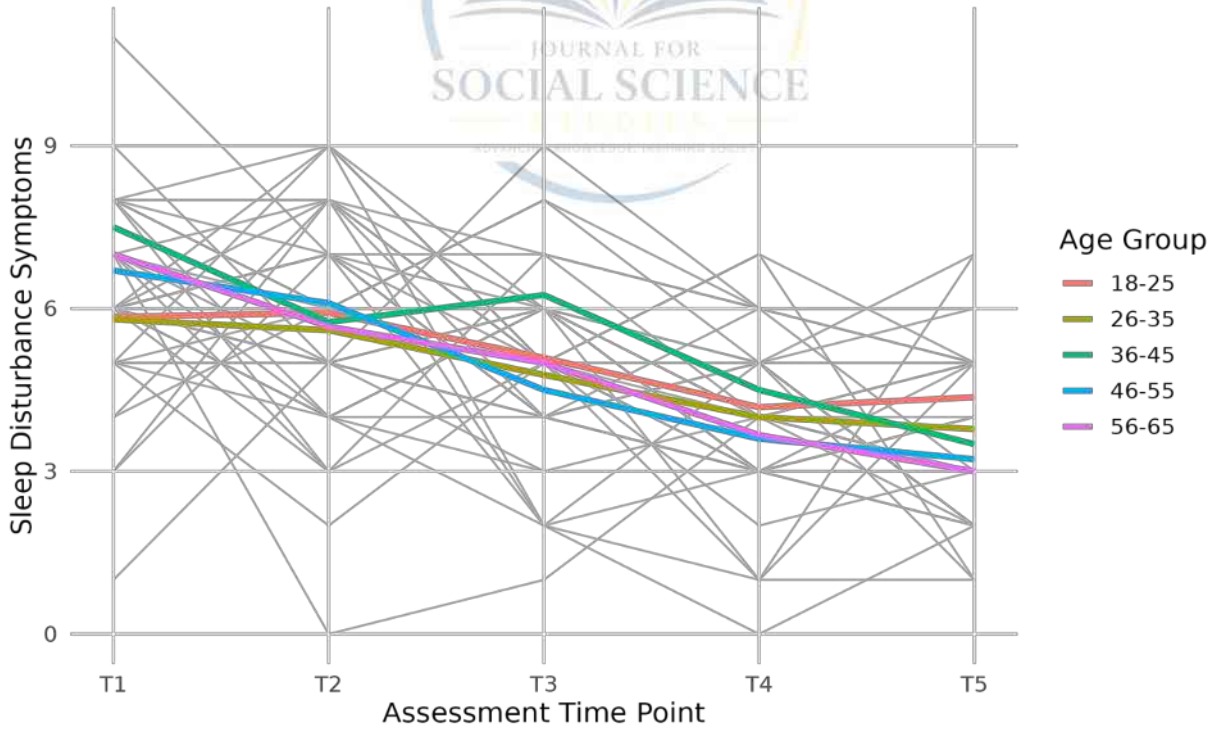

Figure 6. Individual and Age-Group-Mean Trajectories: Sleep Disturbance (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

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Sexual Problems

Table 8: Growth Curve Model Results: Sexual Problems (Fixed Effects, Random Effects and Model Fit, and Post Hoc Age-Group Slope Comparisons)

Parameter	B / Estimate	SE / SD	df	t	p
FIXED EFFECTS					
Intercept	5.46	0.51	155.80	10.70	< .001**
Time (linear slope)	-0.56	0.14	151.33	-3.90	< .001**
Age Group: 26–35	-0.91	0.77	155.42	-1.18	.241
Age Group: 36–45	-0.06	1.04	154.33	-0.06	.954
Age Group: 46–55	0.17	0.77	155.27	0.23	.822
Age Group: 56–65	-1.43	1.17	154.24	-1.22	.223
Time × Age Group: 26–35	0.24	0.22	149.49	1.13	.261
Time × Age Group: 36–45	0.01	0.29	144.46	0.05	.961
Time × Age Group: 46–55	0.02	0.22	147.02	0.10	.918
Time × Age Group: 56–65	0.40	0.32	143.99	1.25	.215
RANDOM EFFECTS AND MODEL FIT					
Intercept Variance (ID)	0.62	0.79			
Residual Variance	2.43	1.56			
Log-Likelihood	-368.29	—			
AIC	760.58	—			
BIC	799.55	—			
POST HOC PAIRWISE COMPARISONS (TUKEY-ADJUSTED)					
18–25 vs. 26–35	-0.24	0.22		-1.13	.791
18–25 vs. 36–45	-0.01	0.29		-0.05	1.000
18–25 vs. 46–55	-0.02	0.22		-0.10	1.000
18–25 vs. 56–65	-0.40	0.32		-1.25	.725
26–35 vs. 36–45	0.23	0.29		0.78	.935
26–35 vs. 46–55	0.22	0.23		0.98	.864
26–35 vs. 56–65	-0.15	0.33		-0.47	.990

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36–45 vs. 46–55	-0.01	0.29	-0.03	1.000
36–45 vs. 56–65	-0.38	0.38	-1.02	.846
46–55 vs. 56–65	-0.38	0.33	-1.15	.779

*Note. $F(4, 185)$, p, and η^2 for the corresponding univariate repeated-measures ANOVA test of Time for Sexual Problems: $F = 6.74$, $p < .001$, $\eta^2 = .127$. Random-intercept-only growth curve model reported due to singular fit of the random-intercept-plus-slope specification. Reference category for Age Group is 18–25. *$p < .05$, **$p < .01$.*

Sexual Problems declined significantly across treatment, B = -0.56, SE = 0.14, t = -3.90, p < .001. Neither the Age Group main effect nor the Time × Age Group interaction reached significance for any contrast (all p ≥ .215), and no post hoc pairwise comparison reached significance (all p ≥ .725).

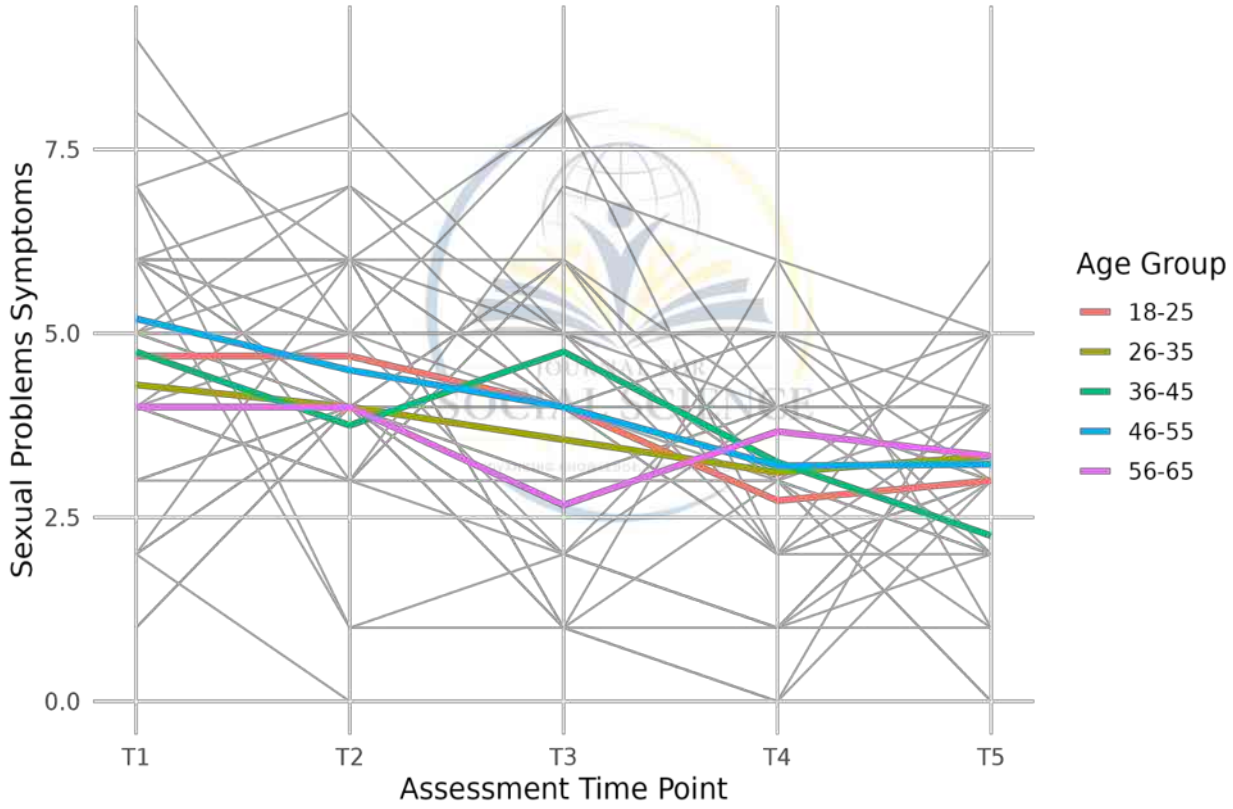

Figure 7. Individual and Age-Group-Mean Trajectories: Sexual Problems (T1–T5). Thin grey lines represent individual participant trajectories; colored lines represent age-group mean trajectories.

Summary of Age Group Moderation Across Outcomes (Hypothesis 2)

Across all seven trauma symptom outcomes and the 28 Time × Age Group interaction terms tested cumulatively (four dummy-coded contrasts per outcome), only a single term, the 46–55 versus 18–25 contrast for Sleep Disturbance, reached nominal significance prior to correction (p = .047), and this contrast did not survive Tukey adjustment in the corresponding post hoc comparison (p = .272). No age-group main effect reached significance for any outcome, and none of

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the 70 Tukey-adjusted post hoc pairwise slope comparisons conducted across all seven outcomes (ten per outcome) reached significance. The nominal findings in this one pattern are otherwise significant in the other tests, with a number of these tests falling within the null hypothesis range of the alpha level of .05, thus supporting the overall hypothesis (Hypothesis 2): the rate of trauma symptom reduction that occurred during EMDR treatment was not meaningfully different by age band of participants.

Discussion

The present study involved the evaluation of the overall magnitude of trauma symptom change and its moderation by age of the participants across an 8 session protocol of EMDR (Desensitization/Reprocessing) among Pakistani adults. As predicted in Hypothesis 1, the seven trauma symptom outcomes all significantly and substantially decreased across treatment (effect sizes (η^2) ranged from .127 to .452), which is comparable to published EMDR effect sizes for interventions of similar length. A meta-regression of EMDR trials for depression found that interventions of 6 to 10 sessions, the range within which the present eight-session protocol falls, produced a moderate effect size (Hedges' g = 0.44), rising to a large effect (g = 1.13) for interventions exceeding eleven sessions (Seok & Kim, 2024), a session-length gradient consistent with the Adaptive Information Processing model's proposal that a fuller course of treatment allows more extensive processing across the full past-present-future target list (Shapiro, 2018), rather than a ceiling effect being reached within the first several sessions.

The pattern of steepest decline occurring between T3 and T4 (that is, between the fifth and eighth EMDR sessions) is a specific and somewhat distinctive finding relative to the broader psychotherapy trajectory literature. Growth curve and latent trajectory studies of cognitive-behavioral and counseling interventions for depression and anxiety have more commonly identified either an early, rapidly decelerating pattern of change concentrated in the first two to four sessions, or a smaller late-responding subgroup showing delayed but ultimately substantial improvement (Saunders et al., 2019). The present sample's aggregate pattern, in which the largest single-interval decline occurred later in the treatment course rather than earlier, is broadly consistent with the AIP model's proposal that EMDR's reprocessing procedure requires the sequential completion of an individualized target list, and that the specific timing of maximal symptom relief may depend on when in that target sequence the most salient traumatic material is addressed, rather than on a fixed, session-count-independent rate of general therapeutic engagement of the kind that may better characterize supportive or psychoeducational early-session effects in other treatment modalities (Shapiro, 2018). This distinction, however, should be interpreted cautiously given the present study's linear mixed-effects approach, which characterizes the average shape of change across the sample rather than identifying discrete trajectory subgroups in the manner of latent class growth analysis; future research applying trajectory-class methodology directly to EMDR treatment data would be needed to determine whether the aggregate late-decline pattern observed here reflects a genuinely uniform late-response trajectory or an average across a mixture of earlier- and later-responding subgroups analogous to those identified in the broader psychotherapy literature.

The small rebound observed between T4 and T5 for several outcomes is consistent with patterns reported elsewhere in the psychotherapy outcome literature, in which post-treatment gains are not always perfectly maintained at follow-up even when the overall treatment effect remains robust. This pattern is unlikely to reflect a failure of treatment consolidation specifically, since all seven outcomes remained substantially improved relative to baseline at the three-month follow-up despite this modest rebound.

The consistent absence of age moderation across all seven outcomes, supporting Hypothesis 2,

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extends the broader trauma-adjustment literature's identification of age as a general correlate of post-trauma recovery trajectory (Galatzer-Levy et al., 2018) by demonstrating that this general association does not extend to the specific context of structured, therapist-delivered EMDR reprocessing. This finding is clinically reassuring: it suggests that EMDR's standard protocol can be applied with equal confidence across the working-age adult lifespan without requiring age-specific pacing or content modification, in contrast to the modest age-related risk gradient identified in general PTSD risk-factor meta-analyses that do not evaluate treatment response specifically (Ozer et al., 2003).

The growth curve models' consistent selection of a random-intercept-only specification, with the random-slope specification producing a singular fit for every outcome, warrants specific methodological comment. A singular fit indicates that the available data did not contain sufficient information to reliably estimate between-person variability in the rate of change, a common occurrence in growth curve models with a comparatively modest number of participants and occasions relative to the number of variance components being estimated (Matuschek et al., 2017); it does not indicate the positive absence of such variability, but rather an absence of statistically detectable evidence for it within the present sample size. This distinction matters for interpreting the age-invariance finding: the present results indicate that any age-related variability in treatment response, if it exists, was not large enough to be detected given 40 participants distributed across five age bands and five assessment occasions, a limitation a substantially larger EMDR-only sample would be needed to resolve with greater precision.

Across the 28 Time × Age Group interaction terms tested cumulatively across all seven outcomes (four dummy-coded age-group contrasts per outcome), a single term, contrasting the 46–55 and 18–25 age bands for Sleep Disturbance, reached nominal significance prior to correction for multiple comparisons ($p = .047$). Consistent with this being a chance finding rather than a genuine age-moderated effect, the corresponding Tukey-adjusted post hoc comparison of the same slope contrast was non-significant ($p = .272$), and no other Sleep Disturbance contrast, nor any contrast for the remaining six outcomes, approached significance. Reporting this isolated nominal result transparently, rather than omitting it, is consistent with recommended practice for multi-outcome trials in which the expected rate of chance findings under a true null hypothesis should be considered explicitly rather than treating every nominally significant p-value as substantively meaningful (Sherry et al., 2023); taken as a whole, the pattern across all 28 tests provides considerably stronger evidence for the absence of age moderation than would be concluded from any single test examined in isolation.

Substantively, the sizeable random-intercept variance retained in every model (for example, an intercept variance of 50.94 relative to a residual variance of 31.13 for Total Traumatic Symptoms) indicates that participants differed considerably from one another in their baseline symptom severity, even though they did not differ detectably in their subsequent rate of improvement once treatment began. This pattern, substantial between-person heterogeneity at baseline paired with a comparatively uniform subsequent trajectory, is consistent with a model in which EMDR's reprocessing mechanism operates on the specific traumatic material presented by each individual client, whatever its starting severity, rather than producing a rate of change that is itself contingent on how severely a client presented at treatment onset. This interpretation is offered as a plausible account consistent with the Adaptive Information Processing model's proposal that reprocessing operates on the content of an individual's specific target memories rather than being rate-limited by global symptom severity (Shapiro, 2018), though the present correlational growth curve approach cannot establish this mechanism directly.

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These findings extend the international EMDR literature in two respects. First, whereas most prior EMDR trials have relied on simple pre-post or pre-post-follow-up comparisons, the present growth curve approach provides a more granular characterization of the shape of within-treatment change, including the specific finding of steepest decline occurring later in the treatment course (between the fifth and eighth sessions) rather than early, a pattern with direct implications for clinical expectation-setting around the pace of improvement. Second, this study provides evidence, within a Pakistani adult sample where controlled EMDR evaluations remain scarce (Husain et al., 2020), that both the overall effectiveness and the age-invariance of EMDR's within-treatment effect, established primarily in Western samples, replicate in this cultural and clinical context.

This study has several limitations. The absence of a comparison condition in the present analysis means that within-treatment decline cannot be definitively attributed to EMDR's specific active mechanisms, as opposed to nonspecific therapeutic factors, regression to the mean, or the natural course of symptom fluctuation over time; the parent trial's between-group comparison, reported elsewhere, addresses this limitation directly. In the present study, the sample size (N = 40) was sufficient to detect the moderate-to-large within-treatment effects that were seen, but was not sufficiently large to detect a true small age-moderation effect; this was discussed above under the heading 'singular fit' of the growth curve models. Lastly, the relatively short follow-up period of 3 months does not provide information on whether the small rebound in several outcomes from T4 to T5 will continue, intensify or dissipate at a longer time point.

These limitations should be directly addressed in future research. More subjects across larger EMDR-only samples, across multiple sites for better power to detect age-moderation effects and generalizability beyond the present sample from one Pakistani city, would enable the random-slope specification used to produce a singular fit in the present analysis to be better estimated, to determine whether there is genuine between-person variability in treatment response rate, but was simply undetectable here. If the follow up period used in the present study (three months) is extended, preferably to six or twelve months, in keeping with follow up periods of major international EMDR trials, it would be clear whether the modest post-treatment rebound seen for several outcomes in the present study is resolved, continues, or widens out over a longer follow up period to a more pronounced pattern of relapse. Finally, directly modeling EMDR treatment-course data using latent class growth analysis or other trajectory-class methodology would enable future research to directly test whether EMDR clients, as well as those from other psychotherapies (Saunders et al., 2019), can be meaningfully divided into distinct early-responder, late-responder, and non-responder subgroups, with direct implications for individualized treatment planning and expectation-setting.

Clinical Implications

The study results have three specific clinical implications. First, the consensus of the trauma symptom reduction across the entire adult age range of 18 to 65 years supports the administration of the standard form of EMDR protocol as a valid way to do so, thereby reducing the need for training and supervision in how to use EMDR across multiple age adapted protocols, especially in settings like Pakistan, where resources are limited and maintaining multiple age adapted protocols for trauma response would be difficult. Second, because EMDR's standard protocol is suitable for all ages, providing EMDR to clients across a demographically diverse adult age range would be easier for practitioners in Pakistan to learn and supervise. Second, the results indicated that symptom reduction was most pronounced at later study sessions (between the fifth and eighth sessions), not at earlier ones, suggesting that symptom benefit may occur at a greater rate following the first few sessions of an 8-session treatment course, thereby raising the likelihood of

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premature discontinuation of treatment by clients and premature clinical judgments of non-response based on early symptom changes.Third, the results showed that the greatest symptom reduction was observed later in the study, between the fifth and eighth sessions, instead of earlier, suggesting that clinicians and clients should be advised to expect a significant amount of symptom change to occur after the initial few sessions of the 8-session treatment course, and to avoid prematurely discontinuing treatment or prematurely judging non-response to treatment based on changes observed during the first 3 – 4 sessions. Third, the low level of symptom rebound between post-test and three-month follow-up results for several outcomes, although not an erosion of the overall durability of treatment gains, suggests that a brief booster contact or check-in timed to close to the end of treatment may be useful during this sensitive period, and future research could directly test this hypothesis.

Conclusion

EMDR produced significant, large, and stable trauma symptom reduction for adults in Pakistan, similar to those reported in published international studies with comparable protocols. This drop was consistent across the age range of adults (18-65), and there was no evidence of age-moderated treatment response on the 7 trauma symptom outcomes. The results validate the use of EMDR's standard protocol in all age groups of adults and offer controlled evidence for EMDR's efficacy within treatment across a Pakistani population where this evidence is limited.

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