

Cognitive Improvements in Child Sexual Abuse Victims Occur Following Multimodal Treatment Program: As Measured by MyCognition Quotient

Matthew Reeson¹, Andrew J Greenshaw¹, Vincent Agyapong¹, Gary Hnatko², Hannah Pazderka¹, Wanda Polzin³ and Peter H Silverstone^{1*}

¹Department of Psychiatry, University of Alberta, Edmonton, Canada

²CASA Child Treatment Facility, Edmonton, Canada

³Be Brave Ranch, Edmonton, Canada

Abstract

Objective: It is well recognized that child sexual abuse (CSA) occurs frequently, with the vast majority of cases never being reported. The impact of such abuse has previously been shown to have both psychological and cognitive impacts that can be long-lasting. However, there is little research regarding any potential improvement in cognitive abilities following treatment. In the present publication, we examine cognitive functioning in victims of CSA, aged between 8 and 12, who were examined at baseline and again during treatment. The treatment program is designed and carried out by an independent charity, and has previously been shown to be very successful in improving symptoms of post-traumatic stress disorder, anxiety, and mood.

Methods: Children aged 8-12 underwent multiple intensive interventions located at a dedicated facility (the Be Brave Ranch) during a 12-month period. We examined cognitive changes during this program, as measured by MyCognition Quotient (MyCQ), a computerized assessment of cognitive abilities including attention, episodic memory, executive function, working memory, and processing speed. Changes in cognitive abilities were compared between baseline and post-treatment scores.

Results: Of the 86 children enrolled in the study, 62 (72.1%) completed at least a baseline assessment. The majority of children showed significant improvements in cognitive scores following treatment, particularly in the areas of attention and working memory. These improvements were maintained at follow-up assessments.

Conclusion: These findings suggest that multimodal treatment programs can lead to significant cognitive improvements in child sexual abuse victims. The MyCognition Quotient is a useful tool to track such changes.

Keywords: Cognition; Children; Sexual abuse; Rating; Treatment; Attention; Memory; Executive function; Processing speed

Introduction

Adverse Childhood Experiences (ACEs) encompass a variety of traumatic incidents commonly experienced in youth [1]. ACEs have been persistently associated with a variety of negative psychiatric outcomes, including early onset mental illness and cognitive deficits [2-6]. Child Sexual Abuse (CSA) is a common ACE with approximately 17% of women and 8% of men experiencing at least one incident [7,8]. In Canada, rates of CSA have been estimated at 15.2% for females and 4.8% for males [9], although it has been suggested that up to 97% of CSA is never reported to authorities [10]. Given its high prevalence rates, it is important to recognize that CSA is associated with a multitude of long-term negative outcomes, including increased risk for substance abuse, suicidal ideation, sexual dysfunction, and cognitive and processing deficits [11-17].

To date there has been only a limited amount of research examining cognitive impairment and ACEs. Preliminary studies have shown reduced verbal comprehension, executive function, and lower IQs, in abused and neglected children [18-21]. To our knowledge, no study has specifically focused on child cognitive impairment in CSA victims. However, some studies examining the link between post-traumatic stress disorder (PTSD) and cognitive functioning in children have suggested that PTSD could be a risk factor for cognitive impairment

[22,23]. With just under half of CSA survivors experiencing PTSD symptoms, it is reasonable to assert that this population is at a higher risk for cognitive impairment [24]. Because the brain is most plastic in early childhood, it is imperative that a thorough understanding of the cognitive risk factors involved in sexual abuse be firmly understood. By developing a more comprehensive grasp on the cognitive domains most affected by CSA, better early-intervention and preventative strategies can be developed [13].

Previously we have carried out a significant amount of research aimed at determining the most effective range of approaches to help youth with mental health issues, often following a range of traumatic events [25-27]. From this, it appears that more intensive multi-modal programs are the most effective in treating trauma-induced mental

***Corresponding author:** Peter H. Silverstone, Professor, Department of Psychiatry, University of Alberta, Edmonton, Canada, Tel: +1-780-407-6576; Fax: +1-780-407-6672; E-mail: peter.silverstone@ualberta.ca

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Domain	Overall	Attention	Episodic Memory	Executive function	Processing Speed	Working Memory
Mean Score	48.61	44.49	54.62	44.34	41.76	61.27
Reference Number	-1.39	-5.51	4.62	-5.66	-8.24	11.27
Standard Deviation	11.53	15.07	14.73	13.32	14.27	14.41
t-value	-0.953	-2.713	2.323	-3.152	-4.281	5.803
p-value*	0.344	0.009	0.024	0.003	0.0001	0.0001

Table 1: Mean MyCognition Quotient scores and standard deviations for each cognitive domain at baseline. The overall mean score was 48.61 (SD=11.53). The lowest mean scores were for processing speed (41.76) and executive function (44.34), while the highest mean score was for working memory (61.27). Significant differences from the age-group standard are indicated by bold p-values.

Assessment Type	Baseline	1 (4-12 wks)	2 (13-22 wks)	3 (23-32 wks)	4 (33-42 wks)	5 (43-52 wks)
Attention	44.49	53.3	52.63	45.21	50.77	50.5
Episodic Memory	54.62	61.18	54.52	50.83	54.84	50.25
Executive Function	44.34	52.31	53.75	45.17	49.25	50.38
Processing Speed	41.76	42.04	44.97	41.24	43.34	45.9
Working Memory	61.27	65.54	68.2	59.72	61.85	65.83
Overall	48.55	49.6	55.93	48.41	51.18	52.99

Table 2: Mean MyCognition Quotient scores for each cognitive domain over the course of treatment. The overall mean score increased from 48.55 at baseline to 52.99 at the final assessment (Timepoint 5). Significant differences from the age-group standard are indicated by bold p-values.

As shown in Table 1, of the five cognitive domains, three—processing speed, executive function, and attention—had mean scores below the age-group standard. Processing speed and executive function had the lowest overall performance; the mean score for processing speed 8.24 points below the age-group standard (p=0.0001); executive function 5.66 points below the age group standard (p=0.003). Working memory had the highest performance, 11.27 points above the age-group standard (p=0.0001).

Cognitive Improvements Over Time

Table 2 shows the mean MyCQ scores for each domain over the course of treatment. Because the children were encouraged to engage in the application on their own time, data collection was not regimented under a strict schedule. As such, we grouped the assessments based on the time since initial admission into 6 different timepoints: Baseline, 4-12, 13-22, 23-32, 33-42, & 43-52 weeks after admission. The mean score for each domain is shown in the tables. Timepoint 2 (13-22 weeks) had the highest cognitive performance with an overall MyCQ score 5.93 points above average; while baseline and timepoint 3 (23-32 weeks) showed the lowest cognitive performance, 1.45 and 1.59 points below average, respectively.

To compare the change in the mean scores for each domain over the course of treatment, a paired sample, two-tailed t-test was carried out. As shown in Table 3, four of the five domains showed positive improvement, with executive function having the most substantial increase at 6.05 points (p=0.0001). The mean of the overall score increased by 4.44 points (p=0.005). Of the five domains, attention, executive function, and working memory showed statistically significant positive changes (p<0.05). Episodic memory was the only domain that had a negative change in mean scores, but it was also had the lowest t-statistic (0.735) and highest p-value (p=0.466). Figure 1 shows a graphical representation of the change in mean scores for each domain.

Figure 2 compares the number of children who were at or above their age standard performance (> 50) at baseline and at final discharge. Episodic memory was the only domain that saw a reduction in the number of children at or above the age standard, with 6 fewer children scoring 50 or above. All other domains saw an increase in the number of children scoring at or above the average for their age; executive function and attention had the largest improvements, with 11 and 10 more children scoring at or above average, respectively.

Discussion

Current research suggests that childhood sexual abuse (CSA), particularly when it leads to post-traumatic stress disorder (PTSD), is a strong predictor of the existence of cognitive deficits [19-24,39].

It may be due, in part, to findings that early-life stress can induce structural and functional changes to important cognitive regions of the brain [40]. Children with histories of childhood maltreatment tend to show less creativity and perform poorer on problem solving tasks than non-abused individuals of similar ages [41,42]. As such, it is essential that any program aimed at treating child sexual abuse survivors include measures of cognitive performance.

The results of this study support three main hypotheses postulated prior to our analysis. First, we theorized that children with a history of sexual abuse would have lower baseline cognitive performance assessments than the age-corrected standard population. While the overall baseline assessment scores were lower than the age-group standard, this difference in the mean scores was not statistically significant. However, three of the five cognitive domains had statistically lower baseline mean scores as compared to the age-group standard. Of interest, baseline scores for attention and executive function were significantly above the age-group standard, which may reflect the positive impact treatment has on the cognitive capacities of a CSA victim.

Second, we postulated that cognitive performance in this population would improve over the course of the multimodal treatment program. This was supported by our findings, with statistically significant improvements being found in both the overall score as well as three of five domains. Interestingly, episodic memory was the only domain that showed a reduction in cognitive performance with treatment.

This is potentially noteworthy because current literature suggests that memories of traumatic events tend to be repressed [43,44]. However, as shown by fMRI studies, hippocampal activity, which is the primary region of the brain responsible for episodic memory, tends to be elevated in individuals with histories of trauma [45]. As such, re-experiencing traumatic events in a controlled manner—a hallmark of Trauma-Focused Cognitive Behavioral Therapy (TF-CBT)—can induce a reduction of neural activity in these overstimulated brain regions, effectively dampening episodic memory performance. Furthermore, individuals with PTSD are particularly susceptible to

deficits in episodic memory [46], often experiencing spouts of vivid memory, usually activated by trauma-related stimuli [47]. Thus, this reduction of episodic memory could conceivably also represent a positive outcome of the treatment program.

MyCQ is particularly useful because scores can be broken down into individual domains of cognitive performance for further investigation.

Nonetheless, it needs to be recognized that this analysis has a few limitations. Firstly, subject data was not controlled for gender, ethnicity, home environment, parental involvement, nature of the sexual abuse, or details regarding the perpetrator. Without this information, more rigorous statistical analysis could not be carried out. Secondly, there was no direct comparison or control group. Although we did compare the group receiving the treatment to an age-matched standard, the absence of a control group means we cannot definitively conclude that the cognitive improvements were directly a result of treatment. Additionally, it would have been useful to have extended our findings past final discharge, to determine whether cognitive improvements held following the end of the treatment program. Finally, because the treatment program was a complex multimodal intervention, it is difficult to determine whether one particular intervention or therapy was responsible for the improvements seen in cognitive performance.

Conclusion

In conclusion, we found that CSA victims have impaired cognitive performance that can be improved with treatments. In terms of measurement, we found that MyCQ is a useful cognitive assessment tool for tracking cognitive performance during treatment in such child-sexual abuse victims. Future research could examine other possible factors including gender, ethnicity, and diagnosis, and this can be helped by the use of control groups in future research. Finally, a number of studies have suggested that a PTSD diagnosis is a better predictor of cognitive deficits than having a history of trauma. By comparing cognitive performance in CSA victims with and without a diagnosis of PTSD, a more refined understanding of the risk factors involved in cognitive impairment can be developed.

