Psychiatry & Behavioral Sciences/College of Osteopathic Medicine

Cognitive Recovery in Early Substance Abuse Treatment

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BACKGROUND

Impairments to cognition following substance abuse may not be entirely repaired by sobriety[1-2].

Working memory, executive function, and attention are the most often recognized cognitive impairments in substance use disorders[3-4]. In addition, opioid use disorder has been shown to impair memory[5-6].

Impairments in these areas of cognitive functioning not only impact the individuals' daily functioning, but may also present additional obstacles in these individuals' pursuit of substance abuse treatment. Studies have shown that cognitive impairment is associated with worse treatment outcomes including higher rates of relapse[4,7].

Objective: Pilot study testing recruitment and retention rates and the natural rate of cognitive recovery in early substance abuse treatment.

Primary Outcome: Compare Baseline and Endpoint scores on the NIH Toolbox Cognitive Measures to determine if there are significant changes in cognition during the first 4 weeks of recovery from substance use.

METHODS

Participants

Participants were 28 adults newly admitted to a residential substance abuse treatment facility. All participants had completed detoxification. The majority of participants were being treated for polysubstance abuse, with 15 participants having primary opioid abuse.

Demographics:

- 89% male
- 89% right-handed
- 68% Caucasian, 32% multiracial; 86% non-Hispanic
- Mean age of 35.25 years (SD 8.58)
- Mean education of 17.5 years (SD 4.73)

Procedure

The participants were evaluated at the beginning of their treatment and again after 4 weeks of treatment.

Participants were evaluated on attention, executive functioning, episodic and working memory, language, and processing speed using the NIH Toolbox Cognition Battery:

- Flanker Inhibitory Control and Attention Test
- Picture Sequence Memory Test
- List Sorting Working Memory Test
- Picture Vocabulary Test
- Oral Reading Recognition Test
- Dimensional Change Card Sort Test
- Pattern Comparison Processing Speed
- Rey Auditory Verbal Learning Test
- Oral Symbol Digit Test.

Table 1: NIH Toolbox Subtest Mean T-Scores

Subtest	*Time1*	*T1 SD*	*Time2*	*T2 SD*	*Change (T2-T1)*	*Change SD*	Change Sig.
Picture Vocabulary	48.46	10.861	51.65	13.679	2.47	7.771	0.458
Oral Reading Recognition	53.54	8.634	58.88	9.74	3.82	9.547	0.062
List Sorting Working Mem.	44.04	8.039	50.76	8.066	5.06	9.556	0.045*
Pattern Comparison	41.96	19.091	57.24	13.818	16.47	16.923	0.002**
Picture Sequence Mem.	51.61	11.259	53.06	10.262	-0.47	7.946	0.864
Flanker Inhibitory Control	43	14.103	48.82	13.201	8.82	9.235	0.002**
Dim. Change Card Sort	51.75	13.321	60.41	13.811	6.47	11.063	0.013*
Auditory Verbal Learning	22.75	5.254	26.06	5.08	1.59	4.124	0.141
Oral Symbol Digit	72.93	17.67	84.12	19.374	10.06	12.774	0.001**

Table 2: Composite Mean T-Scores

Subtest	*Time1 Score*	*T1 SD*	*Time2 Score*	*T2 SD*	*Change Score*	*Change SD*	Change Sig
Fluid Cognition	44.57	12.55	56.12	12.678	11.41	9.849	0.001**
Crystallized Cognition	51.04	10.627	55.94	11.819	3.59	8.063	0.108
Cognitive Total	47.39	10.874	57.18	11.626	8.76	6.906	0.001**

All Toolbox scores are fully corrected t-scores where available.
(Auditory Verbal Learning and Oral Symbol Digit are raw scores)

Key
*=p<0.05
**=p<0.001

C=Treatment Completers
NC=Non-completers

Table 3: Treatment Completers vs. Dropouts

Subtest	Mean-C	SD	Mean-NC	SD	Sig.
Picture Vocabulary	49.18	13.483	47.44	5.548	0.019*
Oral Reading Recognition	55.06	10.213	50.11	4.807	0.134
List Sorting Working Memory	45.71	6.844	41.11	10.422	0.151
Pattern Comparison	40.76	17.669	45.11	22.302	0.27
Picture Sequence Memory	53.53	12.797	48.33	8.916	0.24
Flanker Inhibitory Control	40	15.079	48.78	12.215	0.321
Dimensional Change Card Sort	53	13.555	51.33	13.73	0.918
Auditory Verbal Learning	24.47	5.735	19.33	2.693	0.084
Oral Symbol Digit	74.06	18.301	71.33	16.485	0.758
Fluid Cognition	44.71	12.097	45.44	14.284	0.418
Crystallized Cognition	52.35	13.276	48.44	4.096	0.011*
Cognitive Total	48.41	12.525	46.11	8.462	0.424

RESULTS SUMMARY

- Primary cognitive weaknesses at baseline were in processing speed (Pattern Comparison mean t-score=41.96), attention and executive function (Flanker mean t-score=43.0) and working memory (List Sorting mean t-score=44.04).
- Cognitive recovery during the normal course of early inpatient treatment was significant in the areas of processing speed, attention and executive functioning and yielded significant improvement in the Cognitive Function Composite Score ($p<.01$).
- Treatment retention rate of participants was higher than the overall rate for this treatment unit.
- Participants who completed at least 4 weeks of inpatient treatment versus those who left treatment early had significantly higher baseline vocabulary and crystallized cognition scores.
- ADHD as an exclusionary criteria had a significant impact on recruitment, yielding 9 of the 14 exclusions.

CONCLUSIONS

- Substance abuse is known to cause injury to the brain that may not be fully repaired by sobriety. Consistent with previous research, this pilot study found that patients commonly enter inpatient treatment with inefficiencies in fluid cognition skills.
- Over the course of 1-month of inpatient treatment, this sample of patients experienced significant improvement across multiple domains, with significant improvements in composite Fluid and Total Cognition scores.
- This pilot study informs a series of planned studies on cognitive recovery. Further study on the pattern of cognitive changes during substance abuse treatment may be used to help better match intervention strategy to cognitive level and possibly develop cognitive rehabilitation protocols to increase treatment engagement and extend abstinence via improvement in cognitive capacity.

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