MRI and Neuropsychological Outcomes following Cognitive Rehabilitation Training in Traumatic Brain Injury: A Multiple Case Study

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INTRODUCTION

Background: Cognitive struggles frequently persist beyond the recovery period following traumatic brain injury (TBI). Deficits are injury-dependent but typically involve memory, processing speed, and reasoning skills.

LearningRx is a clinician-delivered cognitive rehabilitation training program that targets multiple cognitive skills through repeated engagement in game-like but rigorous mental tasks in 90 minute training sessions at least three days per week. The current study examined neuropsychological, functional, and neuroimaging outcomes following 60 hours of LearningRx training with 5 clients post-TBI.

Research Problem: We have reported improvements in cognition and/or neural connectivity in multiple studies on LearningRx cognitive training programs. However, no studies using LearningRx for Traumatic Brain Injury (TBI) have examined neural correlates of cognitive change with this population.

METHODS

• Using a multiple case study design, we examined changes in IQ score, working memory, long-term memory, visual & auditory processing, processing speed, attention, reasoning, and everyday functioning following 60 hours of cognitive training for 5 clients with Traumatic Brain Injury.

• We also examined neural connectivity changes with MRI.

• Neuropsychological assessments included the Woodcock Johnson IV – Tests of Cognitive Abilities and the Patient Competency Rating Scale.

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RESULTS

Example of a working memory training task

• The intervention targeted working memory, long-term memory, processing speed, attention, visual processing, auditory processing, and reasoning skills.

• Training intensity was tightly controlled by the clinician using a metronome, timer, and deliberate distractions to “load” the participant with several simultaneous tasks. A metronome added to the intensity and ensured that mental breaks were minimized.

• Clients attended three 90-minute training sessions per week for 14 weeks.

• MRI performed on a Siemens 3T MR scanner and included acquisition of a T1 weighted, high resolution (512x512x192) anatomical image, and a 12-minute resting state EPI BOLD functional acquisition (TR = 3 secs).

CONCLUSIONS

• In all five cases, remediation of both cognitive and life skills was achieved with LearningRx cognitive rehabilitation training.

• mTBI participants exhibited significant training-induced changes in neural connectivity.

• Normalization of the Default Mode Network (DMN) was evident in the severe TBI case along with the appearance of anti correlations and decreased hyperconnectivity.

• Cognitive training appears to be a promising intervention for TBI independent of severity.

REFERENCES


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