The Impact of Clinical Engagement Practices on Cognitive Performance Among Individuals with Acquired Brain Injuries: A Pilot Case Series

Methods

Participants

Participants consisted of three individuals who sustained ABIs and were in the chronic stage of recovery (> 1-year post-incident). The participants were referred to the study through the University of Oregon’s Brain Injury and Concussion Clinic (BrICC), where the first author provided study recruitment materials. Inclusion criteria consisted of (1) having sustained an ABI over a year ago, and (2) persistent moderate to severe deficits in attention demonstrated by performance on a formal cognitive assessment of attention as indicated by the treating speech-language pathologist. Exclusion criteria consisted of an ABI occurring < 1-year ago, mild cognitive deficits, and a clinical diagnosis of aphasia. A chart review and subsequent phone interview was conducted by the first author to identify potential participants and ensure that they met inclusionary and exclusionary criteria.

Table I. Demographic and clinical characteristics of participants.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Participant | Age | Sex | Race | Injury | Date of Injury | Cognitive Severity Classification | Previous Cognitive Rehabilitative Tx | Currently Receiving Services |
| AE | 51 | M | White | TBI | 2018 | Severe | Yes | No |
| EI | 47 | F | Undisclosed | Cerebral  Aneurysm | 2016 | Severe | Yes | No |
| IA | 34 | M | White | Brain tumor resectioning x2 | 2010; 2018 | Moderate | Yes | No |

Procedures

The case series consisted of an exploratory AB design comprising a baseline and intervention phase designed to evaluate whether the addition of a single variable, application of clinician-driven engagement factors, changed performance on a static series of attention tasks. Each participant served as their own control, which was represented by their baseline performance. Upon demonstrations of a relatively stable baseline performance range, each participant then entered the intervention phase. A licensed speech-language pathologist conducted all treatment sessions across both the baseline and intervention phases. All sessions took place over a HIPPA-compliant video teleconference platform.

The baseline phase was comprised of three to five sessions. Sessions occurred on separate days across a one-to-two-week period, each session lasting approximately 20-minutes in length. Baseline sessions were used to establish demonstrations of a performance range and stability across a series of cognitive tasks selected from the APT-3 program. Selected APT-3 tasks included both auditory and visual tasks for two participants, while only auditory tasks were used with one participant. Auditory tasks targeted two primary cognitive domains: working memory or sustained attention, while visual tasks targeted working memory, selective attention, and suppression.

Each task contained a series of subtasks that comprised of a series of drills, which were presented hierarchically, based on complexity. When a participant demonstrated four consecutive correct responses, the drill was ceased and then the clinician would present the instructions for the next set of drills in the subtask hierarchy. When a participant demonstrated three consecutive errored responses, the clinician would cease engaging in the drill and move on to the next drill in the series. Every session would start at the base of the task hierarchy, utilizing different stimuli to avoid task learning, and then continue until they had reached a ceiling across all tasks. To minimize demonstrations of engagement behaviors, the clinician incorporated basic greetings, while activity instructions were scripted and served as the primary form of communication and source of engagement between clinician and participant throughout the baseline phase. Task hierarchies can be found in Table 2 (auditory tasks) and Table 3 (visual tasks).

Table 2. APT-3 Auditory Attention Task Hierarchy

|  |  |  |
| --- | --- | --- |
| Task Sequence Order | Subtasks | Drill Sequence Order |
| 1) Number Sequences | 3-Number Sequences | 1) Reverse |
| 2) Ascending |
| 3) Descending |
| 4) Add 3 |
| 5) Subtract 2 |
| 4-Number Sequences | 1) Reverse |
| 2) Ascending |
| 3) Descending |
| 4) Add 3 |
| 5) Subtract 2 |
| 5-Number Sequences | 1) Reverse |
| 2) Ascending |
| 3) Descending |
| 4) Add 3 |
| 5) Subtract 2 |
| 2) Sentence Sequences | 4-Word Sentences | 1) Reverse |
| 2) Alphabetical |
| 3) Progressive |
| 5-Word Sentences | 1) Reverse |
| 2) Alphabetical |
| 3) Progressive |
| 6-Word Sentences | 1) Reverse |
| 2) Alphabetical |
| 3) Progressive |
| 7-Word Sentences | 1) Reverse |
| 2) Alphabetical |
| 3) Progressive |
| 8-Word Sentences | 1) Reverse |
| 2) Alphabetical |
| 3) Progressive |
| 3) Serial Number Sequences | Multi-Step Calculations | 1) 2-Step Calculations |
| 2) 3-Step Calculations |

Table 3. APT-3 Visual N-Back Attention Task Hierarchy

|  |  |  |
| --- | --- | --- |
| Task Sequence Order | Sub-Tasks | Drill Sequence Order |
| 1) 1-Back | Clock Times | 1) Slow |
| 2) Medium |
| 3) Fast |
| Seasons & Months | 1) Slow |
| 2) Medium |
| 3) Fast |
| Clock Times w/ Motion Distraction | 1) Slow |
| 2) Medium |
| Seasons & Months w/ Motion Distraction | 1) Slow |
| 2) Medium |
| Clock Times w/ Visual Competition Distraction | 1) Slow |
| 2) Medium |
| Seasons & Months w/ Visual Competition Distraction | 1) Slow |
| 2) Medium |
| 2) 2-Back | Animals | 1) Slow |
| 2) Medium |
| 3) Fast |
| Abstract Shapes | 1) Slow |
| 2) Medium |
| 3) Fast |
| Clock Times | 1) Slow |
| 2) Medium |
| 3) Fast |
| Animals w/ Motion Distraction | 1) Slow |
| 2) Medium |
| Abstract Shapes w/ Motion Distraction | 1) Slow |
| 2) Medium |
| Clock Times w/ Motion Distraction | 1) Slow |
| 2) Medium |
| Animals w/ Visual Competition Distraction | 1) Slow |
| 2) Medium |
| Abstract Shapes w/ Visual Competition Distraction | 1) Slow |
| 2) Medium |
| Clock Times w/ Visual Competition Distraction | 1) Slow |
| 2) Medium |

The intervention phase consisted of an additional three sessions for each participant. Sessions occurred on separate days across a one-to-two-week period, each session lasting between 50-125 minutes in length. During the intervention phase, session processes mirrored those of the baseline phase; however, each participant was exposed to series of clinician-driven engagement practices.

To establish specific clinician-driven engagement practices, an extensive literature search was conducted to identify a series of behaviors associated with engagement by targeting patient optimism, acceptance, motivation, self-efficacy, and therapeutic alliance. The search resulted in a comprehensive list of potential engagement practice applications. The list was narrowed by eliminating engagement practices that were not feasibly incorporated into clinical interactions. Each identified engagement practice application was then trialed by graduate student clinicians and the first author during clinical sessions within the BrICC clinic. Engagement application practices were honed and modified based on their feasible and consistent application within clinical sessions.

Prior to study implementation, each condition was trialed to ensure reliability and fidelity between conditions. The first author acted as the treating clinician, utilizing individuals who had not sustained ABIs. Sessions were recorded and two research assistants independently rated the two conditions to ensure that the scripted performance was devoid of selected engagement practices, and that implementation of engagement practices consistently met established criteria. Descriptions of selected engagement practices can be found in Table 4.

Table 4. Clinician-driven engagement practices.

|  |  |  |
| --- | --- | --- |
| Key Engagement Targets | Definition | Applications |
| Motivation/  Optimism | Motivation is an individual’s drive, including their initiation and persistence, towards achieving goal-directed behaviors and outcomes (Ryan & Deci, 2020); Optimism is a generalized expectation and sense of well-being that future events will be positive and achievable (Segerstrom, Carver, & Scheier, 2017) | * Established task-specific goals (e.g., “What can you do to increase your success?”) * Provided specific and encouraging feedback/affirmations (e.g., “You look like you’re really concentrating.”; “You’ve got this!”; “You seem to have good awareness about what is easy or hard.”) |
| Self-Efficacy/ Acceptance | Self-efficacy is one’s belief in their ability to successfully navigate and execute their own actions and decisions (Huang, 2016); Acceptance is when an individual willingly accepts experiences, including unwanted or unexpected situations, without attempting to exert control over the experience or their reaction (Zhang et al., 2018) | * Provided autonomous opportunities (e.g., “Between these two tasks, which do you feel you will be most successful with?”) * Performance prediction and reflection (e.g., “On a scale of 1-5, how challenging do you think this task will be?”; “Now that you completed the task, would you change your rating? If so, why?”) * Provided opportunities for reflective thinking (e.g., “You seem discouraged. Why you think you didn’t perform as well as you’d hoped?”) |
| Therapeutic Alliance | Therapeutic alliance represents a mutual and effective working relationship between a client and clinician resulting from a positive sense of interconnectedness Babatunde, MacDermid, & MacIntyre, 2017) | * Demonstrated reflective listening (e.g., “I remember during our last session you mentioned…”) * Applications of non-verbal engagement practices (e.g., eye contact, prosodic intonation, etc.) * Generalized rapport building (e.g., “Before we begin, I’d love to hear about your week.” * Conducted in-session check-ins (e.g., “How are you feeling right now?”) |

Measures

A series of measures were utilized to track and measure performance change across both conditions. Two repeated measures were utilized: *Attention Process Training, 3rd Edition (APT-3)* and *Consultation and Relational Empathy (CARE).* APT-3 performance served as the primary terminal metric, as a repeated measure for tracking attention performance trends, while the CARE examined subjective change across sessions and conditions. The *Working Alliance Inventory (WAI)* served as a pre and post-test subjective measure.

Repeated Measures: *Attention Process Training, 3rd Edition (APT-3)* – The APT-3 program is a comprehensive, evidence-based direct attention training program aimed at improving underlying attention deficits secondary to acquired brain injury (Sohlberg & Mateer, 2010). The program targets specific domains of attention commonly disrupted after an acquired brain injury including: Basic Sustained Attention, Executive Control: Working Memory, Executive Control: Selective Attention, Executive Control: Suppression, and Executive Control: Alternating Attention. While the APT-3 serves as an attention intervention program, it is intended to be paired with metacognitive strategy instruction to effect attentional change (Lee, Sohlberg, Harn, Horner & Cherney, 2017). For the purposes of the study, participants only engaged in sustained attention and working memory drills, without receiving training in metacognitive strategy instruction. APT-3 is a computer-based cognitive skills training program that utilized the screenshare and remote-control features to allow for participants to access the stimuli and make real-time selections via verbal responses or utilization of their own keyboard.

*Consultation and Relational Empathy (CARE)* – CARE is a patient-rated measure of the interpersonal skills of healthcare practitioners that has been widely validated for use by healthcare professionals in both primary and secondary care settings (Bikker, Fitzpatrick, Murphey, Forster, & Mercer, 2017). The CARE consists of 10 items measuring the participants’ perception of the clinician’s engagement skills by selecting ratings from Poor to Excellent, including an option for Does Not Apply. CARE was administered at the conclusion of each session. The CARE was adapted into a Qualtrics survey, which was shared via a link distributed through the chat feature of a HIPPA-compliant video teleconference platform. Surveys were shared with the participant and/or caregiver during the session to ensure they were completed properly. The clinician turned off their camera and microphone to allow for privacy while completing the survey.

Pre/Post Measure: *Working Alliance Inventory (WAI)* – The WAI is a self-reported 36-item Likert scale questionnaire produces a composite score based on three measures of the therapeutic alliance that assesses three key aspects of the therapeutic alliance: (a) agreement on the tasks of therapy, (b) agreement on the goals of therapy and (c) development of an affective bond (Hovarth, 1994). WAI was administered during the initial and final sessions. The WAI was adapted into a Qualtrics survey, which was shared via a link distributed through the chat feature of a HIPPA-compliant video teleconference platform. Surveys were shared with the participant an/or caregiver during the session to ensure they were completed properly. The clinician turned off their camera and microphone to allow for privacy while completing the survey.

Analyses

APT-3 performance served as the primary measurement to evaluate the presence of a treatment effect between phases through a combination of visual and quantitative analyses. Session APT-3 accuracy results were graphed to facilitate visual analysis of accuracy between both phases for each individual participant (Horner et al., 2005). Observations were made regarding changes in level, trend, and immediacy of effect. The two effect size calculations utilized to determine statistical differences in APT-3 accuracy between the baseline and intervention phases were Percentage of non-overlapping data (PND) and *Tau*-U (Parker et al., 2011).

Results

APT-3 Accuracy

AE

Figure 1 displays the plotted APT-3 accuracy data for Participant AE. Baseline data was observed to maintain stable trend, while a change in level and immediacy of effect were identified to support the presence of a treatment effect upon transition to the intervention phase. The PND calculation yielded a score of 1.0, corresponding to an effective intervention, while the *Tau*-U calculation obtained a score of 0.775, corresponding to a medium to high treatment effect.

Chart, line chart

Description automatically generated

*Figure 1*. Participant AE APT-3 accuracy data.

EI

APT-3 accuracy data for Participant EI are presented in Figure 2. Accuracy was observed to maintain stable trend during the baseline phase. Change in level and an immediacy of effect upon transition to the intervention phase were identified, which supports the presence of a treatment effect for Participant EI. The obtained PND effect size was observed to be 1.0, and the *Tau*-U calculation generated an effect size of 0.732. Taken together, both effect size calculations support the presence of a medium to highly effective treatment response.

Chart, line chart

Description automatically generated

*Figure 2*. Participant EI APT-3 accuracy data.

IA

Participant AI APT-3 accuracy data is presented in Figure 3. Visual analysis of the plotted data identified relatively stable trend throughout the baseline and intervention phases with no significant change in level or immediacy of effect to indicate a treatment effect. The obtained PND effect size calculation generated a value of 0.333, while the *Tau*-U calculation generated an effect size of 0.378. Both effect size calculations supported the visual analysis interpretation to not support the presence of a treatment effect for Participant AI.

Chart, line chart

Description automatically generated

*Figure 3*. Participant AI APT-3 accuracy data.