CASE STUDIES

Outcomes of Cognitive-Communication Intervention in Traumatic Brain Injury: a Case Study

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ABSTRACT

Purpose: *Traumatic brain injury (TBI) is an acquired non-progressive condition, resulting in distinct deficits of cognitive communication abilities such as naming, word-finding, self-monitoring, auditory recognition, attention, perception and memory. Cognitive-communication intervention in TBI is individualised, in order to enhance the person's ability to process and interpret information for better functioning in family and community life. The present case study illustrates the cognitive-communicative disturbances secondary to TBI and its intervention outcomes in a female adult in India.*

Method: *The 43-year-old subject attended 20 sessions of cognitive-communication intervention which followed a domain-general adaptive training paradigm, with tasks relevant to everyday cognitive-communication skills.*

Results: *Improvements were found in perception, short-term and working memory, with reduction in perseverations and naming difficulties.*

Conclusion: *Rehabilitation of clients with moderate to severe head injury can be done effectively through the appropriate selection of goals and activities relevant to the functional needs of each individual.*

Key words: traumatic brain injury, cognitive-communication, perception, memory, rehabilitation

INTRODUCTION

Communication is an overall socially distributed cognitive activity, which incorporates the perception, analysis and execution of information in not just an isolated environment but in a dynamic one which requires coordination at various

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levels, thus making cognition a key feature for basic living and communication (Harris, 2006). The relation between cognition and language is intricate, requires perception, access to long-term memory, association, recognition, attention, lexical retrieval, decision making, motor planning, self-monitoring, and knowledge (MacDonald et al, 2001).

Cognitive-communication disorders are difficulties in various communicative competencies that result from underlying cognitive impairments of attention, memory, organisation, information processing, problem solving, and executive functions (Togher et al, 2013). Traumatic brain injury (TBI) is the largest and most documented condition, with acquired non-progressive brain injury resulting in distinct cognitive communication disorders. The consequences of TBI, in the acute phase and in later stages, depend on the type of trauma, the severity, location, and extent of the brain injury. Traumatic brain injury can affect any area of the brain, and usually more than one area. Communication becomes dysfunctional, inadequate and sometimes ineffective, with difficulties in understanding and producing gestures and facial expressions appropriately; recognising the prosodic aspects of speech; maintaining eye contact; initiating, maintaining or changing the topic of conversation appropriately; adapting vocabulary to different everyday contexts; organising discourse coherently and cohesively; respecting communication shifts; understanding the interlocutor's needs; getting lost in irrelevant comments and uninteresting details; and, inability to make inferences from long and complex content. There is also inability to understand sarcastic utterances or situations where a sense of humour is involved, and sometimes the display of reduced initiative and communicative inhibition/disinhibition (Togher et al, 2013; McDonald et al, 2016). Brain-injured clients may exhibit symptoms such as naming errors, word-finding problems, impaired self-monitoring, and auditory recognition impairments along with other cognitive-communication impairments, such as attention and perception difficulties and impaired memory (Kennedy et al, 1995; Kim et al, 2009; Felix et al, 2019).

For persons with TBI, cognitive rehabilitation — a clinical discipline that encompasses interdisciplinary activity aiming at recovery and compensation of cognitive processes changed by cerebral injury — is crucial. An individual's ability to process, interpret, and respond appropriately to environmental inputs is recovered through a cognitive rehabilitation programme. Additionally, strategies and procedures are developed to make up for lost abilities that are required in interpersonal, social, educational, and professional relationships

(Freire et al, 2011). Although there are many different strategies used in cognitive rehabilitation, it is generally agreed in the literature that each client's needs must be considered.

Studies have distinguished two parts of cognitive rehabilitation therapy: an approach that is restorative and one that is compensating. The goal of the restorative method is to improve, reinforce, or restore the compromised skills. It involves retaking standardised cognitive tests that are harder each time, focusing on certain cognitive domains (e.g., selective attention, memory for new information). The compensatory method teaches strategies for avoiding or making up for the dysfunctional function. The efficient use of assistive technologies (ATs), calendars, electronic memory devices, alarms or reminders, as compensatory approaches, has been documented by a number of authors (Shoulson et al, 2012; Barman et al, 2016). Despite the various efforts to evaluate the effectiveness of cognitive rehabilitation, a clear lack of understanding the exact nature, theory and rationale of the cognitive intervention has been noted (Shoulson et al, 2012).

Speech-language pathologists play a primary role in the screening, assessment, diagnosis, and treatment of infants, children, adolescents, and adults with cognitive-communication disorders. The following case report illustrates the cognitive-communicative behaviours and the management outcomes of an individual with TBI.

METHOD

Case Presentation

A 43-year-old female, a known case of traumatic brain injury consequent to a road traffic accident, was brought to the Department of Audiology and Speech Language Pathology, KMCH, India?, with disturbances in cognitive communicative abilities. Due to the accident, the client had suffered head and facial injuries and fracture of both the forearms. No sensory deficits were present except for a slight vision problem in the left eye due to post- traumatic keratosis. Neurological evaluation was done, and the CT scan revealed bilateral frontal subdural hygroma with significant resolution of bilateral frontal region and left preseptal extra calvarial soft tissue swelling.

Cognitive Communicative Skills

A detailed cognitive communication assessment, which was done informally,

revealed the client to have severe naming deficits along with perseverations, deficits in episodic memory (such as recalling the details of the accident and the places she had visited earlier), deficits in short-term memory and semantic memory (such as difficulty recalling her house address, names of people known to her, as well as the activities she did each day), leading to severe breakdowns in her communicative abilities. On administration of the Mini Mental State Examination (Folstein et al, 1975) and the Manipal Manual of Cognitive Linguistic Abilities (Mathew et al, 2013) it was noted that the client lacked orientation to time and space, while the other cognitive-communicative processes which were seen to be affected included attention, visual and auditory perception, working memory and executive functions, with reasoning abilities remaining intact. The client had difficulty in engaging in conversation with family members as well as friends. Topic initiation and maintenance was severely affected. The client lacked self-awareness and self-monitoring abilities which hindered the application of any form of communication repair strategies. Spontaneous speech, automated speech and repetition skills, which were assessed informally, were noted to be intact.

The baseline pre-therapeutic cognitive-communication skills assessed using the Manipal Manual of Cognitive Linguistic Abilities (MMCLA) (Mathew et al, 2013) revealed poor performance scores on perception, short-term memory, and working memory (as shown in Table 1). Cognitive-communication intervention was recommended thrice a week, with each session to be of one-hour duration.

Table 1: Pre-therapeutic Baseline Scores on MMCLA

Perception	**Pre-therapy Scores (accuracy)**
Auditory letter and word search	7/17
Visual letter search	9/15
Visual picture and number search	1/10
Visual action and feature search	2/10
Short-term memory and Working memory	
Auditory word retrieval	9/20
Auditory word list recall	6/15

Intervention

The client attended cognitive communication intervention thrice a week, for a period of two months, with each session of one-hour duration. The intervention (see Table 2) followed a domain-general, adaptive training paradigm, with tasks relevant to everyday cognitive-communication skills. The client was engaged in general conversation at the beginning of each session, followed by structured therapy tasks targeting various cognitive communication skills, such as name and object recall, sequencing events, letter and categorical free recall of words, and digit and month ordering. The stimuli for these tasks were arranged in a hierarchical order of complexity and were provided in the auditory, visual and/or auditory-visual combined modalities. For every complexity level, 10 sets of stimuli for each task were given for practice in each session. The training moved to the next higher level of complexity only with a consistent progress of 80% accuracy in the targeted level of complexity. Feedback was given after every response.

Table 2: Details of the Structured Intervention

Task	Stimuli	Description	Complexity range (in span/steps)	Stimulus duration	Inter-stimulus duration	Modality	Intervention approach
Name recall	Series of names of persons	You will be presented with a series of names in a simultaneous auditory-visual modality. You are required to remember these names and recall them verbally in any order when the response screen appears.	2-7	2000ms	1000ms	Auditory-Visual	Domain-general, adaptive training paradigm
Object recall	Series of common everyday objects	You will be presented with a series of pictures of common objects in a visual modality. You are required to remember these objects and recall them verbally in any order when the response screen appears.	2-7	2000ms	1000ms	Visual	
Letter and category free recall of words	K, D, S, household objects, body parts, places, animals, fruits	You have to verbally recall as many words as possible which begin with the specified letters and which belong to the specified categories.	Not applicable	Not applicable	Not applicable	Auditory	-

Digit ordering	Series of single digits	You will be presented with a series of single digits in a simultaneous auditory-visual modality. You are required to remember these digits and recall them verbally in ascending order when the response screen appears.	2-7	2000ms	1000ms	Auditory-Visual	Domain-general, adaptive training paradigm
Month ordering	Series of months	You will be presented with a series of months in a simultaneous auditory-visual modality. You are required to remember these months and recall them verbally in any order when the response screen appears.	2-7	2000ms	1000ms	Auditory-Visual	
Sequencing	Everyday tasks (e.g., making a cup of tea)	You will be shown jumbled pictures of action steps for a task and you are required to rearrange them in the correct sequence.	2-5	Not applicable	Not applicable	Visual	

Apart from the structured therapy tasks, certain other activities and games targeting various cognitive-communicative processes were incorporated in the therapy sessions, such as singing games to improve short-term and long-term memory, and auditory perception, spotting the difference to improve visual perception and attention, recalling cooking recipes and planning monthly household needs and budget to improve executive functions. Compensatory strategies were also recommended, by involving the family members in assisting the client to maintain a diary with reminders of daily routine and names of people, use of calendars and alarms for orientation to days, time and place.

RESULTS

Post-therapeutic assessment was done by re-administering the MMCLA and improvements in the performance scores were noted for auditory and visual perception, short-term memory and working memory (as shown in Table 3).

Table 3: Post- therapeutic Scores on MMCLA

Perception	Post-therapy Scores (accuracy)
Auditory letter and word search	10/17
Visual letter search	12/15
Visual picture and number search	9/10
Visual action and feature search	6/10
Short-term memory and Working memory	
Auditory word retrieval	13/20
Auditory word list recall	10/15

Improvements were also noted on some of the trained cognitive-communication task performances (as shown in Table 4).

Table 4: Performance on the Trained Cognitive-Communication Tasks

Task	Baseline Performance	Post-therapy Performance
Digit ordering	**Accuracy**	**Accuracy**
3 span	50%	100%
4 span	0%	100%
Object recall		
3 span	40%	100%
4 span	0%	80%
Sequencing		
3 step	50%	80%
5 step	0%	60%
Free recall	**Number of items recalled**	**Number of items recalled**
Letter K	1 word	4 words
D	2 words	7 words
S	2 words	6 words
Category	**Number of items recalled**	**Number of items recalled**
Household objects	3	8
Body parts	5	9
Places	3	8
Animals	5	6
Fruits	2	6

The frequency of perseverations significantly reduced. The accuracy of correct responses increased with practice. The client also developed interest in independently initiating her day-to-day activities at home as well as involving in conversations with her family members and friends. Though she continued to lack awareness about her deficits, her involvement in the therapeutic activities was noteworthy.

DISCUSSION

Following a TBI, the goal of cognitive communication rehabilitation is to increase the person's ability to absorb and comprehend information as well as to perform tasks requiring mental operations (Barman et al, 2016). A systematic approach towards intervention designs to improve cognitive abilities and their application to normal everyday activities is essentially incorporated in cognitive rehabilitation (Wortzel & Arciniegas, 2012).

The interventions mainly aim at re-establishing or reinforcing the previously learned skills which include repeated exercise of tasks, increasing in complexity, and those targeting certain cognitive domains, developing compensatory strategies for cognitive deficits such as use of electronic memory devices, calendars and alarms, and/or facilitating adaptation to irremediable cognitive impairments (Koehler et al, 2012).Cognitive communication rehabilitation includes the parameters of general interventions which target a range of cognitive processes, and cognitive specific interventions which target a specific cognitive process such as memory or attention (Sanjuán et al, 2020; Gray et al, 2022). Much remains to be learned about the kinds of training programmes that provide meaningful changes beyond the specific skills trained. Cognitive-communicative training will be deemed useful if the training has generalised benefits and builds cognitive capacities to support performance in day-to-day tasks (Chapman & Mudar, 2014).

CONCLUSION

Rehabilitation of moderate to severe head injury clients can be done effectively through holistic cognitive retraining. Hierarchically arranged modules that focus on different cognitive domains in all the modalities form the basis of such programmes. Clients move through these domains at their own pace while mastering each one. Selection of goals and preparation of activities and tasks

should be in relevance to the functional needs of each individual with TBI, as highlighted in the present case report. Compliance of the client, support of the family and long-term follow up are essential for these extensive procedures to be beneficial.

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