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Original article

Effectiveness of a Short-Term Intensive Group Program for Improving Self-Awareness in Patients with Acquired Brain Injury

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Abstract

【Introduction】Individuals with acquired brain injury (ABI) often face significant challenges related to self-awareness, which can hinder their rehabilitation and daily functioning. Impaired self-awareness is one of the most disruptive cognitive deficits post-ABI, impacting social reintegration and long-term outcomes. Improving self-awareness is therefore essential for recovery, as it enables individuals to recognize cognitive deficits, develop compensatory strategies, and participate more effectively in rehabilitation.【Methods】Using a single-system ABA design, 20 participants with ABI were enrolled in a 3-month GT program consisting of 13 weekly sessions. The intervention included psychoeducation, self-monitoring, and structured feedback within small-group activities. Self-awareness was assessed at four time points using the Self-Regulation Skills Interview—Japanese version (SRSI-J). Repeated-measures ANOVA and Bonferroni-adjusted comparisons were conducted, and effect sizes (η^2) were calculated.【Results】Eighteen participants completed the study. Significant improvements were observed in EA, AA, SU, and SE between pre- and post-intervention, which were maintained at follow-up ($p < 0.05$). No significant changes were found in SG and MC, but their stability may reflect sustained motivation. Qualitative analysis of three illustrative cases revealed personalized gains in task performance and self-monitoring.【Conclusion】This study demonstrates that short-term GT can effectively improve key aspects of self-awareness. Its structured yet time-efficient format may offer practical benefits for rehabilitation programs in outpatient and community settings. These findings suggest the potential utility of brief group interventions for enhancing metacognitive function in individuals with ABI.

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Introduction

Impaired self-awareness is a common and significant issue for individuals with acquired brain injury (ABI), often resulting in self-centered behavior, communication difficulties, and challenges in social interactions[1)]. Impaired self-awareness is one of the most disruptive cognitive

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deficits after ABI, significantly affecting rehabilitation outcomes and recovery[2]. Furthermore, difficulties in social reintegration can lead to social isolation, affecting professional stability, family dynamics, and overall well-being[3]. Given these consequences, it is critical to address self-awareness deficits early in the recovery process to support timely social reintegration. In this study, self-awareness is defined as the capacity to recognize and monitor one's own cognitive and functional impairments, and to use that insight to guide behavior and decision-making in daily life. This definition follows prior neuropsychological models that conceptualize self-awareness as comprising emergent awareness—recognizing difficulties as they occur—and anticipatory awareness—predicting potential challenges before they arise[18, 23].

While many of these studies primarily targeted individuals with traumatic brain injury (TBI)[13, 14, 16, 17], others, such as Hashimoto et al.[15], focused on patients with cerebrovascular accidents (CVA). Studies focusing on individuals with CVA may offer a more clinically relevant comparison for the present study, depending on the participants' neurological profiles described later.

However, most of these group-based interventions were implemented over several months, which may pose challenges in terms of accessibility, continuity, and resource allocation. Despite their reported effectiveness, few studies have examined whether shorter-duration programs particularly those lasting less than four months can achieve similar outcomes.

Therefore, this single-system design study using an ABA design aimed to evaluate the effectiveness of a short-term, intensive group training (GT) program in improving self-awareness in individuals with acquired brain injury (ABI). This study uniquely contributes to the literature by focusing on a shorter-duration program, lasting less than 4 months, and exploring its effects on self-awareness, which has not been well studied previously. If effective, short-term intervention programs could provide a more accessible and time-efficient means of supporting social reintegration and improving quality of life for individuals with ABI.

Methods

Research design and participants

This study employed a single-system design study using the ABA method, which consists of three phases: (1) a baseline (pre-assessment) phase during which no intervention was provided; (2) an intervention phase involving GT; and (3) a reversal (post-assessment) phase, during which the effects of the intervention were evaluated after its completion. The target population comprised 20 individuals diagnosed with ABI who were living at home between April and December 2019. The sample included 11 men and 9 women. All participants were members of a family association for individuals with ABI and provided informed consent to participate in the study through interviews. The family association from which participants were recruited comprises individuals with ABI and their family members who are actively engaged in mutual support, information exchange, and reintegration efforts. Many of the members experience ongoing cognitive challenges, including difficulties with self-awareness, and voluntarily participate in educational or rehabilitative activities. As such, this association was considered a suitable source for identifying individuals with chronic ABI who may benefit from structured interventions aimed at enhancing self-awareness. In addition, because the association regularly circulates information on cognitive rehabilitation and brain function, it enabled the identification of participants with the motivation and capacity to commit to the group training program. Of the 18 participants who completed the program, 15 were diagnosed with CVA, including 3 with left hemisphere lesions, 6 with right hemisphere lesions, 3 with bilateral hemisphere involvement, and 2 with lacunar infarctions. One participant had a TBI, and three were diagnosed with inflammatory brain disease. Eligibility criteria included: age between 20 and 85 years; at least 6 months since ABI onset; independence in activities of daily living; intention to reintegrate into social life; and sufficient language and cognitive abilities to understand the study and provide informed consent. Exclusion criteria included: prior participation in GT, inability to complete the intervention, or significant communication disorders.

The elements of GT

Building on the neuropsychological rehabilitation approach implemented at The Oliver Zangwill Centre[4], the group training program comprised three key elements: (1) acquisition of knowledge about the disorder, (2) self-awareness of cognitive and functional impairments, and (3) engagement in planning, execution and reflective proc-

esses.

1. Structured Sessions for Acquiring Knowledge About the Disorder

At the outset of the GT, participants were provided with an overview of the training objectives to enhance their understanding of its purpose and content.

Following this introduction, an occupational therapist delivered a structured lecture on higher brain dysfunction, focusing on foundational concepts. The goal was to foster intellectual insight by enhancing participants' awareness of their cognitive impairments. Throughout the session, participants were encouraged to take structured notes to reinforce retention and facilitate cognitive processing of the information presented.

2. Structured Session for Enhancing Self-Awareness of Cognitive Impairments

Following the lecture, participants used a check sheet1 (Figure 1) to identify cognitive and functional difficulties relevant to their daily lives. The check included illustrations and explanatory texts detailing hallmark symptoms of higher brain dysfunction, such as attention deficits, memory impairments, executive dysfunction, and social behavior difficulties. This tool was designed to help participants recognize their cognitive challenges by systematically assessing whether these symptoms applied to their experiences.

After identifying the situations that applied to them, the participants described their experiences in detail. The number of selected responses was recorded to quantify each participant's current difficulties. Using self-check, participants presented and shared their findings with the group. By discussing their challenges, goals, and experiences with higher brain dysfunction, participants gained a deeper understanding of their condition, the orientation of group activities, and the broader impact of neurological impairments.

Each participant underwent individual interviews with a trainer before and after each session. During these interviews, the participants and a trainer used the check sheet 2 (Figure 2). to organize their areas of improvement and the specific challenges they encountered during GT. A key focus of the interview was goal-setting, where participants used the interview to clarify their objectives for the next session. Additionally, participants determined the strategies they would implement to achieve their goals and quantified their projected achievement levels. The interviews included structured components that tracked the participants' progress across multiple sessions.

3. Structured Session for Gaining Experience in Planning, Execution, and Reflection

Participants organize their difficulties through a check sheet 2 and engage in activities designed to enhance emergent awareness, which allows them to recognize cognitive challenges as they occur during tasks. Once participants experience instances of emergent awareness, the next goal is to develop anticipatory awareness, which enables them to predict and proactively address potential difficulties. Each session was structured around a single task with varying content. The first and second sessions focused on planning, the third on execution, and the fourth on reflection and revision (Table 1). Participants create a task-specific plan (e.g., playing a game, cooking, or going out).

In the following session, the participants presented their plans, discussed areas for improvement, and refined their approach using insights gained from peer feedback and discussions. In the third session, they executed the task while tracking whether the activity progressed according to the plan. The fourth session involved reviewing the implementation record, identifying areas for refinement, and making targeted modifications to optimize the plan. Through this iterative process, the participants developed structured problem-solving skills and adaptive cognitive strategies, refining their ability to plan and execute tasks efficiently.

Duration of training, composition of participants and staff

GT was conducted once per week for approximately 2 h per session, for a total of 13 sessions, amounting to a maximum of 26 training h. The maximum number of GT participants was set at eight, with individuals divided into two small groups of three to four members. Two occupational therapists served as training staff, collaborating with the overall facilitator to determine discussion content, moderate sessions, and conduct individual interviews. No other staff members were involved in the intervention. To ensure consistency in intervention delivery, the two facilitators participated in a standardization process prior to

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日本語版　SRSI （Self－Regulation Skills Interview ： 自己統制能力質問紙）

氏名：　　日付：　　年　　月　　日　　評価者名：

スクリーニングの質問（問題の抽出）
ご病気や受傷をされた後，変わったと思う点についていろいろ考えてみてください． 最もあなたを困らせていて日常生活に支障をきたしている点を話していただけますか？（主となる問題領域を決定する）
1．出現している問題
「（スクリーニングで抽出した問題）」をどのように体験していますか？　「（スクリーニングで抽出した問題）」について自分自身で気づいていることをくわしく話してください． （付加：ほかに何か気づいていることはありますか？　これまで……とおっしゃいましたね．ほかにはありますか？）
2．問題の予測
最も「（スクリーニングで抽出した問題）」を体験するのはどんな時ですか？　どんな状況で主に起こりやすいですか？ （付加：ほかに，もっとよく（スクリーニングで抽出した問題）が起こることを予測できる状況はありますか？　これまで……とおっしゃいましたね．ほかに何か思いつきますか？）
3．変化への動機付け（＊この項目は対象者が自己評定をする）
「（スクリーニングで抽出した問題）」を克服するのに役立つような方法を習得したい気持ちはどのくらいありますか？ 【まったくない】――――――――――――――――――――――――――――【とてもやりたい】 （リハビリテーションプログラムが終了した後だったら，例えば「習得した方法を使い続けたい気持ちはどのくらいありますか？」と質問を変えてもよい）
4．戦略の生成
今までに「（スクリーニングで抽出した問題）」に対処できる方法を何か思いつきましたか？　それは何ですか？ （付加：ほかに何か役立ちそうなことを思いつきましたか？　これまで……とおっしゃいましたね．ほかに何か思いつきましたか？）
5．戦略の使用
現在，「（スクリーニングで抽出した問題）」に対処するためにどんな方法を使用していますか？ （付加：ほかに何か現在使っている，あるいは最近試したことはありますか？　これまで……とおっしゃいましたね．ほかに使っている方法はありますか？）
6．戦略の効果
現在使っている方法「（5 で得た方法）」はどのくらい効果的ですか？ （付加：どのようにして，「（5 で得た方法）」が有効かもしくは有効でないとわかりますか？　もしその方法を使用することをやめたら何か変わりますか？）

Reproduced with permission from Miyahara et al. (2012), "Development of Self-Regulation Skills Interview in Japan: reliability and validity," General Rehabilitation, 40(8), 1117–1126. [In Japanese].

Figure 1．SRSI-J（Self－Regulation Skills Interview Japanese Version）

program implementation. This included observing mock interviews, reviewing session procedures, and using a check sheet2（Figure 2）to standardize key behaviors, such as how to prompt self-reflection and provide feedback. The two occupational therapists who facilitated the GT sessions had an average of 12.0 years of clinical experience (SD = 1.0), both specializing in cognitive rehabilitation for individuals with ABI.

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Introduction

Date : Name :

Higher cerebral dysfunction affects daily life in many ways.
To improve higher cerebral function, it is necessary to pay attention not only at the time of training, but also, in daily life.In this group training, **the goal is to understand what you are not good at,understand what you can improve, and acquire compensatory strategies.**

Have you experienced a situation like these?
Let's think about which situations applies to you in your daily life!
If something similar has happened to you, try to remember about your own experience!
Check the boxes of the situations that apply to you and write about your own experiences!

Check!

Write about your own experience
Be as specific as possible.

① In the morning, I am intense! In the afternoon I am exhausted. ☐

② I get tired very easily. I feel exhausted. ☐

③ I can't concentrate because I am paying attention to others around me. ☐

④ I forget the things I need to remember when I get distracted by other things. ☐

⑤ I thought I would remember what I was going to do but I can't remember. ☐

⑥ I worry about other things and I can't concentrate on the task at hand. ☐

⑦ I can't keep up with both speed and accuracy. ☐

⑧ When I receive multiple instructions at the same time, I get confused. ☐

⑨ I have trouble organizing the various documents and it becomes a mess. ☐

Total number of checks checks

Figure 2. Check Sheet for Facilitating Self-Understanding of Cognitive Challenges

Table 1. Plan-Do-Check Activity Workflow

Number of times	Topic of activity	Content of activity	Elements
1	Planning and executing a game	Split into smaller groups Consult and propose the necessary items according to the plan	Planning experience
2		The smaller groups present to each other Revise the planning sheet according to the points mentioned Complete the planning sheet	Planning experience
3		Execute according to the planning sheet Take records of the implementation	Execution experience
4		Revise to improve the planning sheet based on the implementation record	Reflection experience
5	Cooking in groups	Split into new smaller groups Consult and propose the necessary items according to the plan	Planning experience
6		The smaller groups present to each other Revise the planning sheet according to the points mentioned Complete the planning sheet	Planning experience
7		Execute according to the planning sheet Take records of the implementation	Execution experience
8		Revise to improve the planning sheet based on the implementation record	Reflection experience
9	Research on the local community in groups	Split into new smaller groups Consult and propose the necessary items according to the plan	Planning experience
10		The smaller groups present to each other Revise the planning sheet according to the points mentioned Complete the planning sheet	Planning experience
11		Execute according to the planning sheet Take records of the implementation	Execution experience
12		Revise to improve the planning sheet based on the implementation record	Reflection experience

Assessment method

Assessment period

Assessments were conducted at four time points: (1) baseline assessment (BL) conducted three months before the GT intervention, (2) pre-assessment (Pre) immediately before the intervention, (3) post-assessment (Post) immediately after the intervention, and (4) follow-up assessment (Follow) conducted three months post-intervention. To avoid bias, the order of the assessments was randomized for each participant. All assessments

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were conducted by five occupational therapists who were not involved in the delivery of the GT sessions and were independent of the authorship team. These repeated assessments allowed us to evaluate both immediate and longer-term changes in neuropsychological and self-awareness outcomes, and to identify the temporal patterns and sustainability of intervention effects. These evaluators had an average of 7.2 years of clinical experience (SD = 4.1), ensuring adequate professional competency while maintaining independence from the intervention team.

Content of assessment

Demographic characteristics were assessed based on age, sex, educational history, and time since disease onset. Neuropsychological assessment included measures of intellectual, general cognitive, visual-spatial, memory, and executive functions. Intellectual function was evaluated using the Japanese version of the Wechsler Adult Intelligence Scale (WAIS-J)[5]. General cognitive function was assessed using the Japanese version of the Mini-Mental State Examination (MMSE-J)[6]. Visual-spatial function was measured using the Japanese versions of the Trail Making Test A and B (TMT-J Part A) and TMT-J Part B)[7]. Each section had a maximum time limit of 300 s[8]. If a participant failed to complete the task within the allocated time, the trial was terminated, and a score of 300 s was recorded for statistical analysis. Memory function was assessed using the Japanese version of the Rivermead Behavioral Memory Test (RBMT-J)[9]. Executive function was examined using the Japanese version of the Behavioral Assessment of the Dysexecutive Syndrome (BADS)[10].

The validity and reliability of these neuropsychological assessments have been established, confirming their effectiveness in evaluating cognitive function in individuals with ABI and other neurological conditions.

In addition to the group-level statistical analyses, qualitative insights from participant interviews were also examined to capture aspects of self-awareness that may not be fully reflected in standardized assessments such as the SRSI-J. Following the intervention, three participants were selected post hoc as illustrative cases based on pronounced qualitative changes in their verbal expressions during individual interviews. These cases were chosen not according to predefined criteria or planned sampling, but rather to exemplify the kinds of cognitive and behavioral changes that emerged through participation in GT and were observed through their evolving narrative content.

Assessment of self-awareness

Self-awareness was assessed using the Japan Self-Regulation Skill Interview (SRSI-J)[11] as summarized in Figure 3. SRSI-J is the Japanese adaptation of the Self-Regulation Skill Interview (SRSI)[12], a structured tool designed to evaluate self-awareness in individuals with brain injuries. The questionnaire consists of six domains: (1) emergent awareness (EA), (2) anticipatory awareness (AA), (3) motivation to change (MC), (4) strategy generation (SG), (5) strategy use (SU), and (6) strategy effectiveness (SE). Participant responses were scored on a 0-10 scale according to standardized guidelines. For readiness to change (item 3), higher scores indicated a greater willingness to change, whereas for the remaining domains, lower scores reflected higher levels of self-awareness. Because this is a non-normative, semi-structured assessment, the SRSI-J has several advantages. This allows for an individualized evaluation of a participant's living environment, assessing not only awareness of disabilities but also the ability to generate and apply compensatory strategies. Furthermore, because the SRSI-J does not compare participants' scores against normative data, it is less susceptible to individual variability and respondent bias[11].

Ethical considerations

This study was approved by the Ethics Committee of the Graduate School of Health Sciences, Kobe University (No. 737) and the Ethics Committee of Kansai University of Welfare Sciences (No. 18-39). The study participants were fully informed of the purpose, methods, potential risks, and benefits of the study, and written informed consent was obtained. All collected data were anonymized, and security measures were implemented to protect the participants' privacy. The researchers declare that there are no conflicts of interest related to this study.

Statistical analysis

All data were analyzed using IBM SPSS Statistics version 24, and the results are expressed as mean ± standard deviation. Repeated measures one-way ANOVA was used to assess changes across time points (BL, Pre, Post, Follow). To evaluate changes before and after the pro-

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Higher cerebral goal setting and reflection discussed during the interview

User name: Name of interviewer: year month day ( )

Feedback content					
<Before the training>					
【Verification of the overall goal】 "The goal for today is ○○". etc.					
【Verification of personal goal】 "From the overall goal, please name a specific task that you would like to work on". etc.					
【Personal goal before the training】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
【Approach】 "So, how exactly would you like to approach the task?" etc.					
【Verification of specific strategies】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
【Projected achievement score】 "So, how much of the challenges and problems do you think you can achieve with that approach? Please represent					Points
【Verification of the projected achievement score before the training】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
<After the training>					
【Reflection of the overall goal】 "The goal for today was ○○. How did it go?" etc.					
【Reflection on the personal goal】 "How did it go for your personal goal?" etc.					
【Reflection on the personal goal from before the training】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
【Reflection on the approach】 Specifically, how did you approach it, and what was good and what was not good or bad in your approach? Dig deeper into the problem here. (Open-ended answer) "What was good about your approach? What was insufficient? Did you encounter any new issues?" etc.					
【Reflection on the approach】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
Coordination volume	Even without doing, took initiative to speak.	It took some time and then took initiative to speak out.	There was an interval with no remarks, I gave some advice and then took initiative to speak.	Gave advice and took initiative to speak.	Gave a lot of advice and took initiative to speak.	Make advices but does not take initiative to speak out.
【Verification of the projected achievement score after the training】 "Look back on your training and show how well you achieved your						Points
【Verification of the projected achievement score after the training】	Spoke clearly.	Spoke broadly without much details.	It was a little vague.	It was vague.	Cannot say.
【List up the problems】 "Earlier, when you summarized your points above, ○○ and ○○ were mentioned, but are there any other issues or problems (things that need to be addressed) that you notice"? etc.					
Coordination volume	Even without doing, took initiative to speak.	It took some time and then took initiative to speak out.	There was an interval with no remarks, I gave some advice and then took initiative to speak.	Gave advice and took initiative to speak.	Gave a lot of advice and took initiative to speak.	Make advices but does not take initiative to speak out.
<For the next training> (preparation)						
【Verification of the goal for the next session】 "Now, from the issues and problems that you mentioned earlier, please name the issues that you will work on next time". etc.						
【Approach】 "So, how exactly would you like to approach the task?" etc.						
【Projected achievement score】 "So, how much of the challenges and problems do you think you can achieve with that approach? Please represent with a numerical score."						Points
【Others】 Would you like to add anything else, such as impressions. etc.?						

Figure 3. Check Sheet for goal setting and reflection discussed

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gram, the normality of the TMT-J was confirmed. The significance of other neuropsychological tests and the Self-Regulation Skill Interview—Japanese version (SRSI-J) was assessed repeated measures one-way ANOVA, with Bonferroni correction applied for multiple comparisons. The assumptions of normality and homogeneity of variance were confirmed for all measures prior to analysis, and no outliers were detected. In all statistical analyses, the significance level was set at $p < 0.05$.

Results

Participation rate

Of the 20 participants, two withdrew from GT, leaving 18 participants included in the analysis. The reasons for withdrawal were hospitalization for medical examinations and poor health conditions.

Demographic characteristics at BL

The demographic characteristics at BL are presented in Table 2. The mean age of participants was 51.7 years (± 12.6), and the mean years of education were 13.2 years (± 1.5). The average time since injury was 92.6 months (± 71.3), and all participants were residing at home. Among them, one participant was self-employed with family support, five were in sheltered employment programs, four were actively seeking work, four were receiving life training from welfare services, and four were utilizing nursing care services.

The results of the neuropsychological assessment at BL are presented in Table 2. The average Full-Scale Intelligence Quotient was 83.3 (± 21.8), with six participants scoring 100 or higher. The mean MMSE-J score was 25.1 (± 3.6), with 13 participants scoring 24 or higher.

For the TMT-J, the mean TMT-J Part A completion time was 97.7 s (± 56.2), and no participant exceeded 300 s. The mean TMT-J Part B completion time was 156.7 s (± 89.4), with four participants reaching or exceeding 300 s.

The average Behavioral Assessment of the Dysexecutive Syndrome (BADS) score was 12.9 (± 3.8), with 11 participants scoring 12 or higher. The mean RBMT score was 10.9 (± 6.9), and 12 participants scored above the age-specific cutoff. Overall, these baseline cognitive scores suggest that the participants exhibited mild-to-moderate cognitive impairments, consistent with typical chronic ABI profiles.

Table 2. Baseline (BL) Demographic Characteristic, Neuropsychological Assessment Results, and Scores of SRSI-J

ID	Diagnosis[a]	Age	Gender	Education	Mn since onset	Occupation or status	WAIS-JⅢ FIQ	MMSE-J Score	TMT-J PartA (S)	TMT-J PartB (S)	BADS Score	RBMT Score	SRSI-J				
													Motivation to Change	Emergent awareness	Anticipatory Awareness	Strategy Generation	Strategy Use	Strategy Effectiveness
1	TBI	42	M	12	261	welfare services	106	30	74	133	10	15	7	8	8	6	7	7
2	CVA (left hemisphere)	34	F	14	128	welfare services	112	26	26	46	19	0	10	8	6	5	5	5
3	CVA (left hemisphere)	43	F	14	26	self-employed	70	24	69	128	11	2	7	10	10	10	10	10
4	CVA (left hemisphere)	61	M	12	216	welfare services	59	26	201	300	13	4	9	9	9	10	10	10
5	CVA (right hemisphere)	29	F	16	17	receiving nursing care	79	25	46	63	14	22	10	5	5	7	7	7
6	CVA (right hemisphere)	52	M	12	28	Unemployed	101	30	38	52	13	21	10	4	4	5	5	5
7	CVA (right hemisphere)	57	F	14	72	employment support office	110	28	50	54	14	23	10	4	5	4	5	5
8	CVA (right hemisphere)	58	M	16	11	welfare services	87	28	105	133	16	9	8	8	9	9	9	10
9	CVA (right hemisphere)	61	M	12	87	receiving nursing care	64	25	118	180	10	9	7	9	9	9	9	9
10	CVA (right hemisphere)	67	M	12	55	Unemployed	56	18	157	300	8	6	0	10	10	10	10	10
11	CVA(lacunar type)	35	F	14	72	employment support office	57	24	125	300	10	10	10	8	9	8	8	10
12	CVA(lacunar type)	48	F	12	125	employment support office	98	30	71	91	17	17	9	8	10	10	10	10
13	CVA (bilateral hemispheres)	63	M	12	9	receiving nursing care	77	23	252	199	8	9	6	9	9	10	10	10
14	CVA (bilateral hemispheres)	63	M	12	84	receiving nursing care	59	18	85	204	13	5	6	9	9	10	10	10
15	CVA (bilateral hemispheres)	69	M	12	89	Unemployed	120	29	84	124	12	20	9	7	7	8	8	8
16	Inflammatory brain disease	32	F	14	80	employment support office	112	25	100	73	15	8	10	8	8	6	5	9
17	Inflammatory brain disease	53	M	12	216	employment support office	69	22	58	141	22	12	0	10	10	10	10	10
18	Inflammatory brain disease	63	M	16	91	Unemployed	64	21	99	300	8	5	5	8	8	10	10	10
	average value	51.7		13.2	92.6		83.3	25.1	97.7	156.7	12.9	10.9	7.4	7.9	8.1	8.2	8.2	8.6
	SD	12.6		1.5	71.3		21.8	3.6	56.2	89.4	3.8	6.9	3.1	1.8	1.8	2.1	2.0	1.9

a: Cerebrovascular Accident (CVA), Traumatic Brain Injury (TBI)

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Result of SRSI-J at the time of BL

The SRSI-J scores at BL are presented in Table 2. The mean EA score was 7.9 (±1.8), and the mean AA score was 8.1 (±1.8). The mean MC score was 7.4 (±3.1), while SG and SU scores were both 8.2, with standard deviations of (±2.1) and (±2.0), respectively. The mean SE score was 8.6 (±1.9).

Results of comparison between BL-, Pre-, Post-, Follow- period groups

Multiple comparisons were conducted using ANOVA with Bonferroni correction to examine variations across the different assessment periods (BL, Pre, Post, and Follow). The results of these comparisons are shown in Tables 3.

No significant differences were observed between groups in MMSE-J, TMT-J Part A, TMT-J Part B, RBMT, and BADS.

Repeated-measures ANOVA revealed significant main effects in several SRSI-J domains: EA ($F = 5.71$, $p < 0.01$, $\eta^2 = 0.20$), AA ($F = 5.40$, $p < 0.01$, $\eta^2 = 0.19$), SG ($F = 3.79$, $p = 0.05$, $\eta^2 = 0.14$), SU ($F = 3.90$, $p = 0.05$, $\eta^2 = 0.15$), and SE ($F = 4.91$, $p = 0.01$, $\eta^2 = 0.18$). Based on these findings, Bonferroni-adjusted pairwise comparisons were conducted. Significant improvements were found in EA and AA between BL and Post, BL and Follow, Pre and Post, and Pre and Follow ($p < 0.05$, $p < 0.01$). SU and SE scores also showed significant gains between BL and Follow. Although pairwise comparisons for SG and MC did not reach significance, the overall trend in SG suggests a potentially meaningful improvement.

These effect sizes fall within the medium to large range, suggesting that the observed improvements in self-awareness and cognitive strategy use were not only statistically significant but also clinically meaningful.

Changes in self-awareness observed during the GT in 3 patients

To illustrate how participants' subjective understanding of their cognitive and behavioral difficulties evolved over the course of GT, three representative cases were selected based on notable qualitative changes in their narrative expressions during interviews. These examples are not intended to be exhaustive or statistically representative, but rather to provide a contextualized view of how self-awareness developed in ways not fully captured by

Table 3. Between-Group Comparison of Each Neuropsychological Test and SRSI-J Test Results (n = 18)

Experiment group	BL	Pre	Post	Follow	F-value	P-value	η^2	P-value[a]	P-value[b]	P-value[c]	P-value[d]	P-value[e]	P-value[f]
MMSE-J	25.1±3.6	26.1±3.1	25.8±3.3	26.8±3.1	0.85	0.47	0.04						
TMT-J PartA	97.7±56.2	106.8±59.2	101.7±59.2	85.8±44.8	0.46	0.71	0.02						
TMT-J PartB	156.7±89.4	193.7±136.9	191.4±179.5	176.5±164.2	0.24	0.87	0.01						
BADS	12.9±3.8	14.2±4.7	14.7±5.2	16.7±5.2	1.97	0.13	0.08						
RBMT	10.9±6.9	12.3±8.3	11.1±8.1	13.0±7.3	0.30	0.82	0.01						
Motivation to Change	7.4±3.1	7.3±9.1	8.8±2.3	8.2±2.2	1.11	0.35	0.05						
Emergent Awareness	7.9±1.8	7.7±2.0	5.7±2.6	5.2±2.9	5.71	<0.01**	0.20	1.00	<0.05*	<0.01**	<0.05*	<0.05*	1.00
Anticipatory Awareness	8.1±1.8	7.8±2.1	5.7±2.7	5.4±3.1	5.40	<0.01**	0.19	1.00	<0.05*	0.014*	<0.05*	<0.05*	1.00
Strategy Generation	8.2±2.1	7.9±2.2	5.9±2.8	5.7±3.4	3.79	<0.05*	0.14	1.00	0.12	0.06	0.24	0.13	1.00
Strategy Use	8.2±2.0	8.0±2.1	6.1±2.9	5.7±3.5	3.90	<0.05*	0.15	1.00	0.15	<0.05*	0.26	0.09	1.00
Strategy Effectiveness	8.6±1.9	8.4±1.9	6.1±2.9	5.9±3.6	4.91	<0.01**	0.18	1.00	0.05	<0.05*	0.08	0.05	1.00

Multiple comparisons were conducted following one-way ANOVA to identify significant differences.Multiple Comparison Procedure: Bonferroni correction *p<0.05 **p<0.01
a: Significance probability when testing the difference between BL and Pre d: Significance probability when testing the difference between Pre and Post
b: Significance probability when testing the difference between BL and Post e: Significance probability when testing the difference between Pre and Follow
c: Significance probability when testing the difference between BL and Follow f: Significance probability when testing the difference between Post and Follow

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Table 4.Illustrative case summaries showing narrative changes in self-awareness during GT

	Characteristics	Initial self-awareness	First Term(BL)	Mid Term(Pre)	Last Term(Post)	Final self-awareness(Follow)
Case 1 (Table 2, No. 6)	Easy fatigability	(1) I get tired easily. (2) I can't concentrate because of the sounds and noise around me. (3) I have strong anxiety and I need to be doing something to calm me down. (4) There is no cohesion in my speech.	(1) Did not say anything (2) If the surrounding environment is organized, I can concentrate. (3) I have a lot of anxiety, and if I ask the other person repeatedly, I forget their original goal. (4) I want to summarize what I want to talk about, but I don't know other strategies besides taking notes.	(1) I forgot about the break time. I got tired. (2) When the conversations get exciting, I can't concentrate on the task. (3) I needed more time to work on the task. (4) I was able to make notes on what I wanted to talk about without being incomplete.	(1) I used to do everything by myself but I was able to ask others. (2) I stopped by task when a person walked by. (3) My mind gets full of things I need to think about. (4) I was able to talk to the point while looking back at my notes.	(1) I have gained physical strength, but I think I still need a nap. (2) I've come to understand that when I concentrate, my mind gets tired and also that I get distracted by people's movements. (3) I get distracted by other things. (4) I became able to speak by tailoring my notes to fit me.
Case 2 (Table 2, No. 17)	Not good at communicating	(1) I have difficulty grasping the main point of the story. (2) I stop in the middle of the conversation and start thinking about something else. (3) I have difficulty concentrating and speaking about one thing because I get distracted.	(1) I was able to speak considering the other person's perspective. (2) I end up speaking fast so that the conversation does not come to a pause. (3) I spoke in a sloppy and lengthy manner	(1) I was able to have a conversation with someone who is not good at taking notes by adjusting to their pace. (2) I was so concerned about the reactions of others around me that the conversation stopped and it took a long time. (3) I was able to talk while narrowing down the content of the conversation.	(1) I participated in the discussion while being the notetaker. I was able to align with what the other person was saying. (2) I was able to summarize the opinions of the members within the time limit. (3) When the time limit is approaching, I worry about the time and I get nervous.	(1) I take notes so I don't forget. (2) I talk about unexpected things in the middle of the conversation. (3) I have difficulty prioritizing tasks.
Case 3 (Table 2, No. 1)	Severe memory dysfunction	(1) I forget when doing two things at the same time. (2) I forget things after a while. (3) I get distracted by background noise and forget about the work in I am doing. (4) It takes a long time if I try to be accurate.	(1) Did not say anything (2) When I forgot, I was able to check the details of my work by checking the notes. (3) I feel worried about doing the same thing over and over again. (4) It took a long time and I did not finish the task.	(1) I was able to do with help. (2) I managed to take notes and use it to check my actions. . (3) I can't assess the situation and I rely on others. (4) I was able to shorten the time by preparing in advance.	(1) I was able to do with help. (2) I was able to do while looking at my notes to remind myself. (3) I was able to concentrate by having a clear idea of what I will do. (4) I was able to improve a little by allocating the time.	(1) I get confused when I receive multiple instructions at the same time. (2) I am able to remember by taking notes. (3) I am able to remember until later if nobody talks to me. (4) It takes a long time because I keep checking repeatedly if I try to be accurate.

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quantitative measures such as the SRSI-J.

Table 4 presents the trajectory of the three participants who exhibited changes in self-perception throughout the course of GT. The participant in Case 1 initially exhibited significant anxiety, difficulty prioritizing tasks, and frequent forgetfulness, particularly when engaged in prolonged conversations. Their primary goal was "to independently seek assistance from others and enhance work performance." At the beginning of the GT, their note-taking was disorganized, with scattered and unstructured entries. However, through the implementation of a structured note-taking strategy, they progressively developed the ability to organize their thoughts more effectively. Over time, they successfully acquired two key strategies: seeking assistance from others, and taking structured, purposeful notes. Despite these improvements, the participant continued to experience challenges in sustaining attention, particularly when conversing with multiple individuals. However, they demonstrated an emerging capacity for self-monitoring, recognizing instances of cognitive fatigue, and reflecting on their experiences. Through participation in GT, the individual in Case 1 ultimately developed the capacity to independently seek assistance from others.

The participant in Case 2 struggled with task management and experienced difficulties with cognitive fluency and thought formulation. However, rather than adopting a self-centered approach, they effectively engaged in communication with their peers. Their goal was to learn how to take notes that capture the main points of a discussion. Initially, they were highly attuned to the reactions of those around them, which led to disruptions in their verbal expression, either by pausing mid-sentence or speaking too rapidly. Over time, they developed the ability to structure a sequence of tasks while maintaining an awareness of time within GT. Additionally, they became capable of referring to their notes while speaking, improving coherence. However, persistent challenges remain, including tangential speech, difficulties in prioritization, and an inability to integrate information systematically. Through GT, the participants' strength emerged in their ability to engage in reciprocal social interactions and demonstrate empathy toward others. This growth contributes to increased self-confidence.

In Case 3, the participant exhibited pronounced impairments in focused attention and memory function. The goal was to develop effective note-taking skills. Initially, their challenges included prolonged task completion times and task abandonment owing to memory deficits. Additionally, they experienced increased anxiety as task demands escalated. As GT progressed, when they encountered task difficulties, they developed the ability to prepare in advance and allocate their time more effectively. Their self-awareness was initially limited; however, over time, they became capable of engaging in concrete self-reflection, which facilitated problem-solving and task performance improvements.

Discussion

Improved self-awareness through GT

In this study, approximately 26 h of GT was conducted over a 3-month period with patients diagnosed with higher cerebral function disorders to enhance self-awareness. The statistical analysis revealed significant differences in the EA, AA, SU, and SE scores of the SRSI-J between the baseline and post-intervention assessments, indicating measurable improvements in self-awareness. The observed effect sizes for these domains ($\eta^2 = 0.20$ for EA, 0.19 for AA, 0.15 for SU, and 0.18 for SE) fall within the medium to large range, suggesting that the improvements in self-awareness were not only statistically significant but also clinically meaningful. These findings support the robustness of the intervention's impact on metacognitive functioning. These findings suggest that a short-term group training program can be effective in enhancing self-awareness and could inform future clinical practices in the rehabilitation of patients with ABI. Moreover, the observed effect sizes for EA, AA, SU, and SE ranged from $\eta^2 = 0.15$ to 0.20, indicating medium to large effects. These findings underscore not only the statistical but also clinical significance of the improvements in self-awareness following the GT program. In particular, the effect size for EA ($\eta^2 = 0.20$) suggests that participants exhibited substantial changes in their ability to recognize emerging problems in real time. Such magnitudes of change support the utility of this short-term intervention in achieving functionally meaningful outcomes within a limited timeframe. These findings are consistent with prior research[13-17] supporting the effectiveness of GT in promoting self-awareness. Additionally, our program, with only 24 h of training, showed comparable outcomes to longer interventions, such as those of Hashimoto et al. (2010) and

Prigatano et al. (1996)[15, 17], suggesting that even short-term, intensive group training can lead to significant improvements. This supports the feasibility and effectiveness of time-constrained interventions in patients with ABI. Educational approaches and feedback interventions have been recognized as effective in enhancing self-awareness[18]. Furthermore, the baseline SRSI-J scores observed in our participants—mean scores of 7.9 (± 1.8) for emergent awareness and 8.1 (± 1.8) for anticipatory awareness — were substantially higher than normative scores reported in healthy individuals, indicating a lower level of self-awareness. According to data presented in the Japanese validation study of the SRSI-J[11], healthy individuals generally score below 5 in these domains. This discrepancy confirms that the study population comprised individuals with significant impairments in self-awareness, thereby justifying the appropriateness of targeting this group for structured metacognitive intervention. Future research should include direct comparisons with healthy control groups to further clarify the severity and intervention thresholds for impaired self-awareness in chronic ABI. Additionally, prospective memory (PM) plays a crucial role in the generalization of self-awareness strategies, facilitating the acquisition of compensatory mechanisms for PM[19].

SG and self-regulation are influenced by the anticipated outcomes of learning opportunities and self-initiated activities[20]. In our proposed intervention, participants acquired knowledge of higher brain functions, engaged in structured reflection opportunities during each session, and participated in goal-oriented feedback discussions following each GT session.

By designing three structured plans, setting a goal framework for each session, and incorporating feedback discussions to evaluate goal feasibility, participants developed experience in strategic planning and implementation. This process allowed them to anticipate and manage predictable cognitive challenges while acquiring compensatory strategies through structured feedback.

Additionally, because GT incorporates active engagement components, we propose that participants gained self-directed learning opportunities through active participation in structured activities. Based on these findings, we contend that our results are consistent with those of previous studies.

Maintenance of MC

There was no significant difference between groups in MC scores in SRSI. The absence of significant changes in MC may seem surprising; however, it is important to note that the maintenance of motivation can sometimes be facilitated by the absence of immediate change. In our study, the lack of substantial improvements in MC could indicate that participants were able to maintain their motivation for change by recognizing that the process of change itself does not necessarily require immediate, visible outcomes. This aligns with research suggesting that sustained motivation is often supported by the stability of the current state, especially when external pressures or expectations are minimal. This concept emphasizes the value of incremental progress, where participants may find satisfaction in the continuity of their efforts, even if major changes are not immediately evident. This suggests that MC were maintained even after the GT concluded. Additionally, the average MC scores remained high, reinforcing the stability of cognitive improvements.

According to Toglia and Kirk (2000)[21], overestimating performance can have unintended consequences, including confusion, decreased self-esteem, reduced effort, and lower persistence. Furthermore, negative effects such as lower satisfaction, diminished self-efficacy, externalizing blame, avoidance behaviors, and negative social feedback can emerge when self-appraisals are inaccurate. Because our GT model is based on repeated feedback (FB) to optimize self-evaluation, participants progressively developed the ability to anticipate future challenges and obtain predictable outcomes. As a result, they demonstrated the capacity to respond calmly, sustain self-esteem, maintain motivation, persist in efforts, trust external feedback, accept constructive criticism, and engage in positive social interactions. We propose that SA was maintained through participants' enhanced sense of satisfaction, accomplishment, and self-efficacy. Furthermore, our findings suggest that GT sustains motivation and reinforces long-term SA improvements.

Sustainability of Self-Awareness Improvements at Follow-Up

At the follow-up assessment conducted three months after the intervention, improvements in EA, AA, SU, and SE were maintained. This indicates that the effects of the short-term GT program were sustained over time, likely

due to its structured design incorporating goal setting, feedback, and self-reflection. Although no additional gains were observed between the post-intervention and follow-up assessments, the absence of decline suggests that participants retained self-monitoring and strategy use in their daily lives. These findings support the potential of short-term interventions to produce lasting improvements in self-awareness. Future research should examine whether post-intervention support could further extend or reinforce these effects.

Changes in the Three Cases

Three participants who completed GT demonstrated individualized improvements through social interaction, which led to enhanced task performance. These improvements were reflected in SRSI-J scores, particularly in EA and AA, which showed significant gains after the intervention. For instance, one participant exhibited improved EA alongside the adoption of specific strategies to manage cognitive challenges. This development was corroborated by both qualitative observations and SRSI-J data. Notably, the participant became increasingly capable of considering others' perspectives, which contributed to strategy selection appropriate to their individual needs. Prior research suggests that experiential and procedural learning is especially effective in individuals with memory impairments (Wilson, 1999)[22], and that self-awareness interventions require integration of cognitive and biopsychosocial approaches. The GT framework established a small-group setting that fostered repeated social interaction and structured reflection. Within this environment, participants observed and evaluated each other's behaviors, gaining insight into their own cognitive and interpersonal functioning. This promoted metacognitive growth through self-evaluation, strategy refinement, and improved self-regulation. While these effects were observed in only three cases, they suggest that interpersonal engagement in GT has the potential to enhance metacognitive abilities. Further investigation is needed to determine whether these benefits generalize to a broader ABI population.

Implications for Broader Rehabilitation Settings

Taken together with the quantitative findings, these case observations support the practical value of short-term, structured group interventions. In light of these findings, short-term, intensive group training may serve as a practical and scalable intervention model within rehabilitation settings. Unlike longer-duration programs that may require extensive resources or prolonged engagement, our short-term approach yielded clinically meaningful improvements in self-awareness within a condensed timeframe. This suggests potential applicability in outpatient care, community-based services, or transitional rehabilitation settings where time or resources are constrained. Moreover, such interventions may contribute to improved social reintegration, reduced caregiver burden, and enhanced readiness for vocational or educational re-entry. Thus, short-term GT offers a time-efficient and sustainable strategy for supporting functional outcomes in individuals with ABI.

Selection bias

The participants in this study were required to attend GT sessions consistently, which could have led to a sample that was not fully representative of all individuals with ABI. This potential selection bias should be considered when interpreting the results, as it may limit the generalizability of the findings to a broader population of patients with ABI.

Addressing the Lack of Long-Term Follow-Up

Although the improvements observed in this study are promising, the lack of long-term follow-up limits our understanding of whether these changes are sustained over time. Future research should include longer follow-up periods to assess the lasting impact of group training interventions and determine whether improvements in self-awareness and metacognitive control are maintained.

Future Research Directions

Future research could explore whether the improvements in self-awareness observed in this study lead to real-life changes, such as improved social integration and employment outcomes. Moreover, as the present sample included individuals with different neurological etiologies —such as cerebrovascular accidents, traumatic brain injury, and inflammatory brain disease—it would be valuable to investigate whether the effectiveness of group training varies by diagnostic category. Additionally, it would be valuable to examine the long-term effects of short-term interventions like GT, particularly their impact on patients' daily lives and overall quality of life.

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Limitations

Limitations related to participants

This study included patients who consistently attended GT sessions. Therefore, participants needed to have stable symptoms, the ability to travel with or without assistance, and adequate communication skills. The sample size was inherently limited because the participants were selected based on specific inclusion criteria from a heterogeneous population of individuals with higher brain function disorders. Given these constraints, our findings may primarily apply to a partially localized patient group, limiting their generalizability to broader populations with diverse neurological impairments.

Limitations related to the period of intervention

Since this study aimed to evaluate the effectiveness and maintenance of GT within a 3-month period, we did not assess whether these effects persisted beyond three months post-intervention.

Conclusion

The findings of this study indicate that short-term GT is effective in enhancing SA in individuals with higher cerebral dysfunction. Repeated-measures ANOVA revealed significant improvements in emergent awareness (EA) and anticipatory awareness (AA), with medium to large effect sizes ($\eta^2 = 0.19\text{-}0.20$), suggesting not only statistical but also clinical significance. These improvements likely contribute to the development of strategic behaviors and better adaptive functioning.

Future research should incorporate long-term follow-ups to examine the durability of intervention effects and their real-life applications. Specifically, exploring how long-term improvements in self-awareness contribute to functional outcomes, such as employment status, community involvement, or overall quality of life, would be valuable. Additionally, future studies could benefit from including control groups or conducting comparative studies to further validate the findings.

Overall, this study provides empirical support for time-efficient rehabilitation programs that promote metacognitive development and self-regulatory skills in individuals with ABI, holding meaningful implications for clinical practice in outpatient and community-based rehabilitation.

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Conflict of Interest

The authors declare no conflict of interest.

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