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Structured Abstract

Clinical Question: For adult patients with cognitive linguistic impairment because of traumatic brain injury (TBI), is the use of internal and/or external memory strategies beneficial to memory outcomes compared to alternative or no treatment?

Method: Systematic Review

Study Sources: Comprehensive EBSCOhost database search (i.e., ERIC, Academic Search Complete, Psychology and Behavioral Sciences Collection, Education Source), speechBITE, Cochrane Library, PubMed, PsycINFO, PsycBITE, and the ASHA Practice Portal

Search Terms: traumatic brain injury OR TBI AND intervention OR treatment OR therapy, cognit*, memory, internal strateg* OR external strateg*

Number of Included Studies: 11

Primary Results: The use of internal and external strategies to facilitate positive memory outcomes for TBI patients is supported. A variety of internal and external strategies have been studied with consistent positive results.

Conclusion: Both internal and external strategies should be considered for use as compensatory techniques for memory impairments in adults with traumatic brain injuries. The evidence presented in this paper explores a variety of internal and external strategies, and outcomes have revealed an overall positive effect. These strategies have important implications for clinical decision-making for improving patient quality of life after TBI.

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Clinical Scenario

Betty is 6 months into her clinical fellowship year as a medical-based speech-language pathologist providing therapy services at a hospital outpatient clinic with an adult patient population. Patients with ongoing primary diagnoses of motor speech and language disorders comprise the majority of Betty's caseload. Betty has not had much experience working with patients with cognitive deficits with primary impairments in memory.

A patient named John was recently added to her caseload. John is a 49-year-old male with a traumatic brain injury from a motor vehicle accident 1 year ago. Of his many symptoms, the most distressing to John and his family are his long-term and short-term memory impairments. He can no longer consistently remember the faces of family and friends, and he cannot safely navigate to outside errands because he cannot remember the directions to places he has been many times before. Betty has explained to his family that it is possible to use compensatory techniques for memory to improve his quality of life. However, John expressed to Betty he has lost confidence in his abilities and is doubtful compensatory techniques would benefit him.

Betty is interested in identifying internal and/or external strategies that would be a good fit for John as well as identifying the supporting scientific evidence for their use as compensatory techniques for memory deficits. Betty would like to find quality research evidencing whether these strategies have had a positive impact on memory outcomes and whether there is evidence to support either internal or external memory strategies as more effective. Betty tells John that she understands his concerns, and they will discuss whether compensatory techniques would be appropriate for him after she reviews the research literature.

Background Information: Adults With Traumatic Brain Injury

The American Speech-Language-Hearing Association (ASHA) calls traumatic brain injury (TBI) "an insult to the brain caused by an external force" (Dennis, 2009). TBI can result from a wide variety of initiating events and present with a wide variety of symptoms, but memory impairment is one of the most common manifestations. The degree of memory impairment an individual may suffer depends on the exact manner and place in which the brain was damaged. Short-term and long-term memory may be affected in different ways, and in some instances it may appear that one type of memory was left untouched while another was critically impacted. The variability of patient characteristics regarding severity of injury and severity of memory impairment brings about this question: Can internal and/or external memory strategies benefit the majority of this patient population, and is one type of memory strategy (i.e., internal or external) more effective than the other?

This brief explores both internal and external strategies practiced as memory compensation techniques. Internal strategies involve mental manipulations that promote retention of select stimuli (O'Neil-Pirozzi et al., 2010). They include mnemonic devices, such as counting, repeating, categorization, face–name associations, visualization, and rhyming methods that "facilitate storage and retrieval" from short- and long-term memory (Perna & Perkey, 2016). Internal strategies may target a specific task, such as formation of an acronym to recall a regimen, or they may be more general, such as the use of visual imagery to recall useful information and assist with completion of functional daily tasks (O'Neil-Pirozzi, Kennedy, & Sohlberg, 2016).

External strategies, on the other hand, reduce the cognitive load on an individual using external aids, which may include personal electronic planners, scrapbooks, timers, checklists, and a wall or pocket calendar to store and reclaim short- and long-term memories (Perna & Perkey, 2016).

Clinical Question

In Betty's initial search for evidence, she wanted to know if the efficacy of internal memory strategies was greater than that of external memory strategies so that she could determine the best type of strategy to use in her intervention with John and future clients with similar needs. She searched for studies that included evidence for both strategies. It is widely accepted that using internal/external memory strategies results in positive memory outcomes for specific memory tasks and activities of daily living. However, there is a lack of research comparing internal strategies to external strategies. The existing body of evidence compares the memory outcomes for compensatory memory strategies (either internal or external) to memory outcomes in control groups that received alternative treatments (such as spaced retrieval and errorless learning) or no intervention. Therefore, Betty changed her clinical question to reflect the existing body of data so that she could have a foundation to make the best clinical decision.

Betty used the PICO (population, intervention, comparison, outcome) format to develop the following question to guide her review of the research: Would an adult with cognitive linguistic impairments because of traumatic brain injury (P) benefit from the use of internal and/or external memory strategies (I), as compared to an alternative or no intervention (C), as shown by improvements in memory outcomes (O)?

Search for the Evidence

Betty's inclusion criteria required using internal/external strategies as primary interventions, a majority adult population with memory deficits secondary to a traumatic brain injury diagnosis, and measurement of memory outcomes. Additionally, articles needed to provide an intervention and be published in peer-reviewed journals. In following the line of her PICO question, Betty sought out studies that focused primarily on internal and external interventions. Subsequently, cognitive rehabilitation studies where internal/external strategies were only part of a bigger whole were excluded. Further exclusion criteria applied to Betty's search were: studies conducted or published in a language other than English, patients with neurodegenerative comorbidities, and studies conducted before the year 2000 to ensure quality research standards. Betty used these criteria when searching for relevant articles within the following databases and resources: comprehensive EBSCOhost database search (i.e., ERIC, Academic Search Complete, Psychology and Behavioral Sciences Collection, Education Source), speechBITE, Cochrane Library, PubMed, PsycINFO, PsycBITE, and the ASHA Practice Portal. The search terms were: traumatic brain injury OR TBI, intervention OR treatment OR therapy, cognit*, memory, internal strateg* OR external strateg*. Betty read titles and abstracts to determine relevance to her PICO question. This search returned 55 articles. Betty also manually searched the references from two systematic reviews that she found, but no new studies were added to her total pool of articles. Table 1 presents the 11 studies that met Betty's eligibility criteria and were relevant to her review. Two of these studies were systematic reviews, seven were group comparison studies, and two were single group designs. These 11 studies are further explored and summarized in the following section.

Evaluating the Evidence

After Betty collected these 11 articles, she evaluated their quality. She knew that there were rating scales she could use to evaluate the methodological quality of the studies and therefore the overall body of evidence. For the systematic reviews, she chose the Evidence in Augmentative and Alternative Communication (EVIDAAC) Systematic Review Scale (Schlosser et al., 2008), and for the group design studies, she chose the PEDro-P scale, which is a version of the Physiotherapy Evidence Database (PEDro; Maher, Sherrington, Herbert, Moseley, & Elkins, 2003) modified by PsycBITE. Table 2 presents review criteria for the EVIDAAC and PEDro-P scale.

The most recent review, by O'Neil-Pirozzi and colleagues (2016), investigated the use of internal strategies to improve memory outcomes for individuals with traumatic brain injury. Forty-six studies were included in the review, with a total of 1,143 participants. From the total population, 84% of participants across studies had sustained traumatic brain injuries. Of the studies that reported time post-injury, time since onset was greater than 1 year for

54% of the participants. Most of the studies reported age information, with a range of 8–86 years old. A variety of specific and generalized internal strategies were used across studies. The overall findings across studies suggest that participants with brain injury benefit from internal strategy training. O'Neil-Pirozzi et al. (2016) examined the quality of the studies to determine the strength of the evidence. Strength of evidence was enough to satisfy requirements for being a Practice Guideline. The EVIDAAC rating for this study was 11/14.

The second systematic review by Sohlberg et al. (2007) focused on using external aids as a memory compensation technique for individuals with brain injury. This review examined 21 articles for key information about population characteristics, types of interventions, outcomes, and methodological quality. There was a total of 270 participants across studies, the majority of whom were adult males, with chronic post-injury memory deficits. Although there were varied etiologies of brain injuries, the inclusion criteria required studies to have at least one TBI subject (with one exception). The TBI subpopulation was also the largest across studies. The types of external aids used in the studies varied, but the most common were memory notebooks. This may have been because electronic devices were too complex for persons with severe memory problems. Outcomes of the studies collectively support using external aids for memory compensation following TBI. The strength of this evidence supports using external memory aids for memory compensation following brain injury as a Practice Guideline. The EVIDAAC rating for this study was 7/14.

A randomized controlled trial by Lannin et al. (2014) investigated the effectiveness of using handheld computers to improve memory in individuals who had memory functioning impairment after an acquired brain injury. The study's 42 participants had the following characteristics: older than 17, diagnosis of acquired brain injury, and functional memory impairment. The participants were split into an experimental group and a control group. The experimental group was given a personal digital assistant (PDA) with training and had to complete five training modules within 8 weeks. The control group was trained by an occupational therapist to use nonelectronic memory strategies. There were significant differences between the outcomes of the two groups. The individuals who used the PDAs demonstrated fewer memory failures with less frequency of forgetting per caregiver questionnaire. This study was rated 8/10 on the PEDro-P scale.

Another randomized controlled trial (O'Neil-Pirozzi et al., 2010) examined the effects of internal memory rehabilitation strategies on participation within a memory group intervention study of individuals with acute, moderate, and severe memory impairments secondary to traumatic brain injury. The internal memory interventions used in the study included categorization and clustering (e.g., semantic associations), auditory and visual imagery, and semantic elaboration/chaining. There were 94 total participants in the study, consisting of middle-age women and men. Each had endured a traumatic brain injury within the past 12 months and noted difficulty with memory after the traumatic brain injury. After treatment, improvement was noted in semantic associations and overall memory functioning. The PEDro-P rating for this study was 3/10.

Schefft, Dulay, and Fargo (2008) compared the efficacy and generalization effects of an external learned memory strategy (i.e., passive participation) and a self-generated memory strategy (active participation) in 40 adults with average ages of 31 years and 34 years for each intervention group. Participants had suffered a closed-head TBI between 6 weeks and 2 years earlier, with memory deficits ranging from mild to severe. Half the participants were allocated to the read-condition group in which they were given a pair of words presented graphically and verbally and were told the rule that connects the pair. These semantic rules included synonyms, antonyms, category, association, and rhyme. The other half of the participants were allocated to the generate-condition group in which they were given one word, the first letter of the second word, and the rule that connects them. The participants were asked to generate the second word. Both groups were then presented with the first word of a word pair and asked to recall the second word. Analysis of the results demonstrated significant effects on improving recognition memory for the generate condition when compared to the read condition. Research indicates that the use of the generate condition in therapy can be generalized for real-world application tasks (Schefft et al., 2008). The PEDro-P rating for this study was 3/10.

Kaschel et al. (2002) compared the impacts of visual imagery training versus pragmatic memory training on memory outcomes for patients with mild memory impairment. Twenty-one participants, with primarily closed-head injuries and a mean age of 36.6 years, completed the study. Participants were randomly assigned to intervention groups receiving either the visual imagery training or the pragmatic training. Study outcomes showed significant

improvement in short- and long-term retention of verbal material for the visual imagery group but no improvement was observed in the pragmatic memory training group outcomes. Improvements in relatives' ratings of memory problem occurrences were also only significant for the visual imagery intervention group. These improvements were still seen at the 3-month follow-up, which suggests maintenance of functional verbal memory changes. The PEDro-P rating for this study was 5/10.

Wilson, Emslie, Quirk, and Evans (2001) evaluated whether using a paging system affected the ability of subjects with memory and/or organizational problems because of brain injury to complete everyday tasks. This randomized control, crossover design study collected complete data from 143 participants with memory and/or planning/organizational problems. The largest subgroup in the population was made up of persons with traumatic brain injuries. Other brain injury etiologies were from stroke, other acquired nonprogressive conditions, and concomitant conditions. The mean age of participants was 38.57 years with an average of 4.9 years passed since brain injury. Results indicate that using the paging system helped 84.6% of participants carry out more daily tasks. It also suggests there is some maintenance of this improvement in functioning for at least 7 weeks following pager use. The PEDro-P rating for this study was 3/10.

A subsequent paper by Wilson, Emslie, Quirk, Evans, and Watson (2005) disaggregated the data from the 2001 study to evaluate the results of the TBI subgroup. There were 63 participants in the TBI group (mostly male), with an age range of 8–83 years old. The average time since injury was 5.3 years. Outcomes from the study showed that 81% of the TBI participants had significant success completing more target tasks when using the paging system than at baseline.

A quasi-experimental study by Bourgeois, Lenius, Turkstra, & Camp (2007) compared the treatment effects of two interventions for improving memory in 38 adults who had suffered a TBI at least 1 year before treatment and had persistent memory problems ranging from mild to severe. The two treatments were spaced retrieval (SR) and didactic strategy instruction (SI), both provided via teletherapy. Therapy sessions for the participants in the SI group included discussions, such as written reminders, association, verbal rehearsal, and imagery. Both treatments resulted in fewer instances of memory problems over time; however, there were limited generalization effects per participant report. No significant effects on quality of life were observed. The PEDro-P rating for this study was 2/10.

A single group research design by Perna and Perkey (2016) examined the effects of internal memory rehabilitation strategies on individuals with acute, moderate, and severe memory impairments secondary to traumatic brain injury. Internal memory strategies, such as word associations, semantic clustering, mnemonics, and visualization, were used during intervention activities. The 11 participants in this pilot study had endured a traumatic brain injury within the 12 months before the start of the study. Five weeks after treatment, significant improvement over pretest was found in immediate free recall and delayed free recall for word lists and story memory (immediate recall). Each participant also reported improved memory.

In another single-group design, Melton and Bourgeois (2005) explored the feasibility and efficacy of teaching memory strategies over the telephone. They used spaced retrieval to train participants to remember to use external memory strategies (e.g., PDA, notebook and pen, routine location) and to recall functional information (e.g., phone number). The study included seven participants with an age range of 33–56 years who presented with memory deficits because of TBI. Memory goals were provided by the patients and/or their families. The results indicate that all participants attained their memory goals. Spaced retrieval approach memory goals were 94.4% maintained, and strategy execution on the goals trained was 77.7% maintained. The authors concluded that spaced retrieval intervention by phone helped facilitate the use of external strategies. Results also revealed that 94% of goals were maintained at the 1-month follow-up after treatment, and the researchers concluded that phone intervention was a viable method of therapy practice.

To assess the methodological quality of the papers collected, Betty used the EVIDAAC for the two systematic reviews and the PEDro-P for the seven group comparison studies. Tables 3 and 4 show that the specific item ratings and total scores varied across studies. Betty recognized, however, that quality inconsistencies may be partly due to changes in quality standards that have occurred over time. The most frequently missed criteria on the PEDro-P were concealment of allocation, blinding of subjects, blinding of therapists, and using an intention-to-treat type analysis; only one paper or no papers satisfied these criteria. The EVIDAAC criteria that were most frequently missed were: whether attempts to locate unpublished studies were

made, whether search terms were stated for each database, and whether a log of rejected studies were reported or made available to the reader. Neither paper satisfied these criteria. Although the methodological ratings of the studies were not consistently high, the overall strength of the evidence points to positive clinical implications, especially considering the findings of the systematic reviews. When collated, the findings support using internal and external strategies as tools to compensate for memory deficits.

The Evidence-Based Decision

Betty considered the information she collected from the studies and the quality of the evidence. Betty's clinical question was: Would an adult with cognitive linguistic impairment because of traumatic brain injury benefit from the use of internal and/or external memory strategies, as shown by improvements in memory outcomes? In the studies presented, the experimental populations consisted primarily of adults who had been diagnosed with TBI and presented with a primary deficit of memory impairment. The 11 studies Betty reviewed suggest positive memory outcomes for adult patients with TBI.

At their next session, Betty shared the results of her investigation with John and his family. She explained the research supporting using internal and external strategies to improve memory outcomes in activities of daily living and how those same strategies might benefit John and his family. John had previously expressed a lack of confidence in the ability of compensatory techniques to meet his daily functional needs, and Betty knew from her clinical experience that patient buy-in is an important factor for therapy success. She thought that if she could find situations where John was successful in using his memory, then any techniques he already used could be scaffolded to future compensatory strategies. Betty asked John and his family to describe things that were easier for him to remember and what he did to remember the targeted information. She listened to what worked for John and his family and counseled them on how internal and/or external strategies could be tailored to fit his needs. John and his family were excited to discuss memory aids that could be built into his routine using familiar tools, such as his cell phone and address book.

Betty reflected on how best to integrate evidence-based practice (i.e., external scientific evidence, clinical expertise, and client/patient/caregiver perspectives) to create a plan of care with John and his family. Everyone agreed that using a combination of internal and external strategies in therapy could help to address the memory deficits affecting his quality of life. Betty used her clinical expertise to help John select specific strategies that would be most beneficial to his goals. She also used her clinical knowledge to select the best training method to teach the selected strategies. Because of her research, Betty felt confident in using internal and external strategies to address John's memory deficits. John and his family found the research encouraging and were motivated to begin using these strategies. Betty made further plans to incorporate John's use of strategies in a variety of situations and environments to promote maintenance and carry-over.

Authors' Note

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Table 1. Summary of Articles Selected for Review

Authors and year	Title	Population	Intervention strategies	Outcomes/ Findings	Quality ratings
Bourgeois, M. S., Lenius, K., Turkstra, L., & Camp, C. (2007)	The effects of cognitive teletherapy on reported everyday memory behaviours of persons with chronic traumatic brain injury	*n* = 38 TBI > 1 year before intervention Persisting memory problems	Spaced retrieval (SR) vs. Didactic strategy instruction (SI); for example, written and auditory reminders and elaboration (external and internal strategy)	No statistically significant effect sizes between groups SR subjects mastered their goals more quickly than SI subjects Both groups reported generalization to nontargeted behaviors	PEDro-P 2/10
Kaschel, R., Della Sala, S., Cantagallo, A., Fahlböck, A., Laaksonen, R., & Kazen, M. (2002)	Imagery mnemonics for the rehabilitation of memory: A randomised group controlled trial	*n* = 21 57% TBI Brain injury > avg. 5 years prior Mean age 42 years Majority male Mild memory impairment	Visual imagery mnemonic training (internal strategy) vs. Pragmatic training control group	Significant improvements in the visual imagery group for short- and long-term retention of verbal material, positive effects seen at 3-month follow-up Relatives' ratings of frequency of memory problems for the imagery group improved but not for the pragmatic group Lack of changes in the pragmatic control group	PEDro-P 5/10
Lannin, N., Carr, B., Allaous, J., Mackenzie, B., Falcon, A., & Tate, R. (2014)	A randomized controlled trial of the effectiveness of handheld computers for improving everyday memory functioning in patients with memory impairments after acquired brain injury	*n* = 42	Personal digital assistant with occupational therapy (external strategy) vs. Control group trained with nonelectronic memory strategies with occupational therapy (external strategy)	Instances of functional memory failure significantly decreased Significant decrease in number of instances of client forgetting in caregiver report	PEDro-P 8/10
Melton, A., & Bourgeois, M. (2005)	Training compensatory memory strategies via the telephone for persons with TBI	*n* = 7	Patients were trained to use memory aids using spaced retrieval techniques via telephone (external strategy)	Memory goals were attained and generalized after five 30-minute sessions	Not rated
O'Neil-Pirozzi et al. (2010)	A controlled treatment study of internal memory strategies (I-MEMS) following traumatic brain injury	*n* = 94	Categorization and clustering (e.g., semantic associations), auditory and visual imagery, and semantic elaboration/ chaining (internal strategies)	Individuals with mild and moderate brain injuries were the best candidates for the internal memory rehabilitation strategies, with improvement noted in semantic associations and overall memory functioning.	PEDro-P 3/10

Table 1. Summary of Articles Selected for Review (continued)

Authors and year	Title	Population	Intervention strategies	Outcomes/ Findings	Quality ratings
O'Neil-Pirozzi, T. M., Kennedy, M. R. T., & Sohlberg, M. M. (2016)	Evidence-based practice for the use of internal strategies as a memory compensation technique after brain injury: A systematic review	*n* = 1,143 84% - TBI Of studies that reported the information: 54% had TBI >1 year before intervention Majority adult males	A variety of specific and generalized internal strategies	Literature base is supportive of internal memory strategy training Uniformity of positive reports indicate strategy instruction should be part of treatment considerations Strength of evidence base = Practice Guideline	EVIDAAC 11/14
Perna, R., & Perkey, H. (2016)	Internal memory rehabilitation strategies in the context of post-acute brain injury: A pilot study	*n* = 13	First letter mnemonics, practicing visualization, semantic clustering, completing worksheets from Workbook of Activities for Language and Cognition, and elaborative encoding (internal strategies)	Improvement was noted in story memory recall, the immediate free recall, and delayed free recall of word lists	N/A
Schefft, B. K., Dulay, M. F., & Fargo, J. D. (2008)	The use of a self-generation memory encoding strategy to improve verbal memory and learning in patients with traumatic brain injury	Study 1: *n* = 20 Study 2: *n* = 20 Closed head injury 6 weeks to 2 years before intervention	Study 1 (Read condition): presented word pairs and rule that connects them (e.g., synonym, category) Study 2 (Generate condition): presented with one word, the first letter of the second word, and the rule that connects them; the subjects had to generate second word. Subjects were asked to produce second word when presented with the first word with which it is associated in the list (internal strategy)	A self-generation intervention (i.e., generate condition) provides a strong effect in improving recognition memory and cued recall test performance compared with the passive didactic presentation of information (i.e., read condition)	PEDro-P 3/10
Sohlberg et al. (2007)	Evidence-based practice for the use of external aids as a memory compensation technique	*n* = 270 TBI largest subgroup Majority adult males Significant memory deficits	A variety of external aids used across studies Memory books: most common	Studies support using external aids to compensate for memory impairments Using external strategies = Practice Guideline	EVIDAAC 7/14

Table 1. Summary of Articles Selected for Review (continued)

Authors and year	Title	Population	Intervention strategies	Outcomes/ Findings	Quality ratings
Wilson, B. A., Emslie, H. C., Quirk, K., & Evans, J. J. (2001)	Reducing everyday memory and planning problems by means of a paging system: A randomized control crossover study	*n* = 143 44% TBI (largest subgroup) Brain injury > avg. 4.9 years prior Mean age 38.57 years Age range 8–83 years Majority male Memory and/or planning/organization problems (unspecified severity)	Simple paging system (external aid) use* vs. Time periods of not using the paging system (time periods 1 and 3 for Group A and time periods 1 and 2 for Group B) *Neuropage	84.6% of all participants were significantly more successful at achieving target tasks when using the pager than in baseline Postpager data for Group A participants (who were significantly more successful using the pagers) showed they were still significantly better than at baseline (7 weeks after returning the pagers)	PEDro-P 3/10
Wilson, B. A., Emslie, H. C., Quirk, K., Evans, J., & Watson, P. (2005)	A randomized control trial to evaluate a paging system for people with traumatic brain injury	*n* = 63 TBI participants from Wilson et al. (2001) study TBI > avg. 5.3 years prior Age range 8–65 Majority male Memory and/or planning/organization problems (unspecified severity)	Simple paging system (external aid) use* vs. Time periods of not using the paging system (time periods 1 and 3 for Group A and time periods 1 and 2 for Group B)	81% of the TBI subgroup were significantly more successful at achieving target tasks when using the pager than in baseline Postpager data for Group A participants (who were significantly more successful using the pagers) showed they were still significantly better than at baseline (7 weeks after returning the pagers)	PEDro-P 3/10

Table 2. Review Criteria for PEDro-P and EVIDAAC Scales

PEDro-P criteria	EVIDAAC criteria
Eligibility criteria presented	Focused question presented
Subjects randomly allocated to groups	Search methods predefined
Allocation concealment	Multiple sources consulted
Groups similar at baseline	Unpublished studies located
Subjects were blinded	Databases carefully selected
Therapists were blinded	Search terms stated and appropriate
Assessors were blinded	Inclusion/exclusion criteria predefined
Measures of one key outcome obtained from > 85% of subjects initially allocated to groups	Inclusion/exclusion criteria appropriate
At least one key outcome measured by "intention-to-treat"	Log of rejected studies available
Results of between-intervention group statistical comparisons were reported for at least one key outcome	Reliable study inclusion
Point measures and measures of variability provided for at least one key outcome	Coding categories predefined
	Data extracted reliably
	Quality criteria predefined and appropriate
	What constitutes effective treatment predefined and operationalized

Note. PEDro-P = Physiotherapy Evidence Database, adapted by PsycBITE; EVIDAAC = Evidence in Alternative and Augmentative Communication.

Table 3. PEDro-P Ratings of Group Comparison Studies

Study	Criteria (✓ = criterion met)											Total for criteria (2–11)
	1	2	3	4	5	6	7	8	9	10	11	
Bourgeois et al. (2007)	✓									✓	✓	**2/10**
Kaschel et al. (2002)	✓	✓		✓				✓		✓	✓	**5/10**
Lannin et al. (2014)	✓	✓	✓	✓			✓	✓	✓	✓	✓	**8/10**
O'Neil- Pirozzi et al. (2010)	✓							✓			✓	**3/10**
Schefft et al. (2008)	✓							✓		✓	✓	**3/10**
Wilson et al. (2001)	✓	✓		✓						✓		**3/10**
Wilson et al. (2005)	✓	✓		✓						✓		**3/10**

Note. PEDro-P = Physiotherapy Evidence Database, adapted by PsycBITE.

Table 4. EVIDAAC Ratings of Systematic Reviews

Study	Criteria (✓ = criterion met)														Score total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
O'Neil-Pirozzi, T. M., Kennedy, M. R. T., & Sohlberg, M. M. (2016)	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	**11/14**
Sohlberg et al. (2007)	✓	✓					✓	✓			✓	✓	✓		**7/14**

Note. EVIDAAC = Evidence in Alternative and Augmentative Communication.