

Introduction

Non-linguistic cognitive skills, such as attention and executive function, have recently become an area of focus in aphasia research. Various investigators have demonstrated that positive responses to treatment of cognitive abilities may also yield improvements in language function (Coelho 2005, Helm-Estabrooks, 1998, and Mayer and Murray, 2002). For example, Helm-Estabrooks (1998) targeted attention, visual memory and visual perception skills for an individual with severe aphasia. Results demonstrated not only improvement in the targeted cognitive skills but also a decrease in the overall aphasia severity rating. Mayer and Murray (2002) designed dual treatment protocols for improving reading and working memory for an individual with mild aphasia and alexia. Results indicated improvements in reading rate but not in comprehension or functional reading. The authors attributed the equivocal results to the possibility that the treatment approaches did not directly target the individual's primary deficits. A similar study targeted attention skills in a treatment protocol for an individual with mild aphasia and mild reading comprehension deficits (Coelho, 2005). Results demonstrated gains in both reading rate and comprehension.

The present study was designed as a replication of the Coelho (2005) investigation. A treatment program was implemented to target complex attention skills for an individual with mild aphasia and mild reading difficulties. Reading rate and reading comprehension were monitored as outcome measures. It was hypothesized that treatment of complex attention skills would improve overall reading rate and reading comprehension abilities for this individual with aphasia. An important addition to the current study was the comparison of the participant's reading performance to that of a matched non-brain-injured control.

Method

Participant

The individual studied, AN, was a 60 year old female 6 months post onset of a unilateral left frontal hemorrhagic CVA. Five days prior to that event, she underwent elective clipping of a left middle cerebral artery aneurysm. AN was a retired high school Spanish teacher and sole owner of a highly successful bakery. Prior to her stroke, AN reported that she enjoyed reading books pertaining to her interests in such topics as Feng Shui and the history of Eastern Medicine. Following her stroke she remained interested in reading however she was unable to read material of the same complexity level because she "lost the train of the message" after reading for short periods of time.

Control

A 66 year old female, with no prior neurological history, was included for comparison purposes. She was a retired Registered Nurse and talented seamstress. She was matched in age and education level to the research participant.

Pre-and Post-Treatment Testing

Formal testing included the Aphasia Quotient from the Western Aphasia Battery (AQ), the Gray Oral Reading Tests – 4 (GORT-4), the Test of Everyday Attention (TEA) and the Attention Process Training-II Questionnaire (see Tables 1 and 2). Based on her formal test results and her report of reading difficulties, AN was judged to be a good candidate for participation in the present study.

Treatment procedures

The treatment procedures were based on those from Attention Process Training-II (APT-II) (Sohlberg and Mateer, 2001). The APT-II is an attention treatment program designed specifically for individuals with mild cognitive impairments. Treatment stimuli are hierarchically organized into levels of increasing difficulty targeting various components of attention. Each treatment task required AN to engage in repetitive drills focused on increasingly complex attention skills (i.e., focused, alternating, selective or divided attention). For example, during the first treatment session, AN was required to listen to a series of words and press a button to identify members of a predetermined class of words. In later treatment sessions she was required to complete a similar task while simultaneously performing a number cancellation task. AN was required to score 80% accuracy on two consecutive trials of a task in order to move on to the next treatment activity.

Treatment probes

A single-subject, ABA, design was implemented to examine the effect of the attention training program on AN's reading ability. Treatment was conducted three times per week for five weeks. Prior to initiating treatment, baseline probes were administered to measure reading rate and comprehension. Treatment probes were administered every other session. For baseline and treatment probes, AN was required to read articles from such magazines as Rolling Stone, National Geographic, Smithsonian, and Vanity Fair and then answer five comprehension questions. The probe articles were comparable in terms of length and complexity. Topics of the articles were selected by AN prior to initiation of the study. A different article was presented for each baseline and treatment probe. Probe articles were always presented at the beginning of a treatment session. All of the articles utilized as baseline and treatment probes were also read and the comprehension questions answered by the individual who served as the control.

Data analyses

Measures of reading rate (words per minute) and comprehension accuracy from each probe were collected and analyzed for AN and the control subject. Inter-judge reliability of the ratings of accuracy for the comprehension questions was nearly 96%. Disagreements were resolved through discussion by the two investigators.

Results

Response to Treatment

Reading rate. Figure 1 reveals that AN's reading rate was consistently slower than that of the control throughout the baseline and treatment phases of the study. However, the variability of her reading rate mirrored that of the control suggesting that AN was functioning similarly to the control just less efficiently.

Reading comprehension. Figure 2 reveals that AN's comprehension accuracy steadily improved over the course of the study. Comprehension accuracy was variable throughout the baseline phase (0-60%) and the first half of the treatment phase (40-80%). During the second half of the treatment phase AN's reading comprehension stabilized at 80% accuracy. This performance was in contrast to the reading comprehension scores of the control whose accuracy remained variable across all 12 probes (60-100%). The control's variability may have been attributable to her lack of interest in the reading topics selected by AN.

Pre- and post-treatment scores. Table 1 illustrates that post-treatment AN demonstrated gains in WAB-AQ, three of four scores from the GORT-4, and six of ten scores from the TEA.

APT-II questionnaire. Table 2 illustrates that positive changes in functional attention skills were reported by AN for seven of the twelve items following treatment. In addition, AN self-reported that she was better able to attend to tasks in "noisy" situations.

Discussion

The following issues will be discussed:

1. The present findings support the study's hypothesis, in that treatment of complex attention resulted in improved attention skills and reading comprehension abilities. These results are consistent with those of Coelho (2005).
2. Unlike the participant from the Coelho (2005) study, AN appeared unconcerned about her slower reading rate and instead focused on increasing her understanding of complex content. This improvement may have resulted in a more effective allocation of her attentional resources.
3. AN's reading skills in many respects were comparable to those of the control subject just less efficient.
4. Prior to the initiation of the treatment program AN's communication skills, including her reading, were very functional. In most rehab settings it is unlikely that she would have been prioritized to receive treatment services. Yet prior to treatment she rated her quality of life as fair to poor because of impaired reading ability.

References

Coelho, C.A (2005). Direct attention training as a treatment for reading impairment in mild aphasia. *Aphasiology*, 19(3/4/5), 275-283.

Helm-Estabrooks, N. (1998). A 'cognitive' approach to treatment of an aphasic patient. In N. Helm-Estabrooks and A.L. Holland (Eds) *Approaches to the Treatment of Aphasia*. San Diego, CA: Singular.

Mayer, J. F. and Murrary, L.L. (2002). Approaches to the treatment of alexia in chronic aphasia. *Aphasiology*, 16, 727-743.

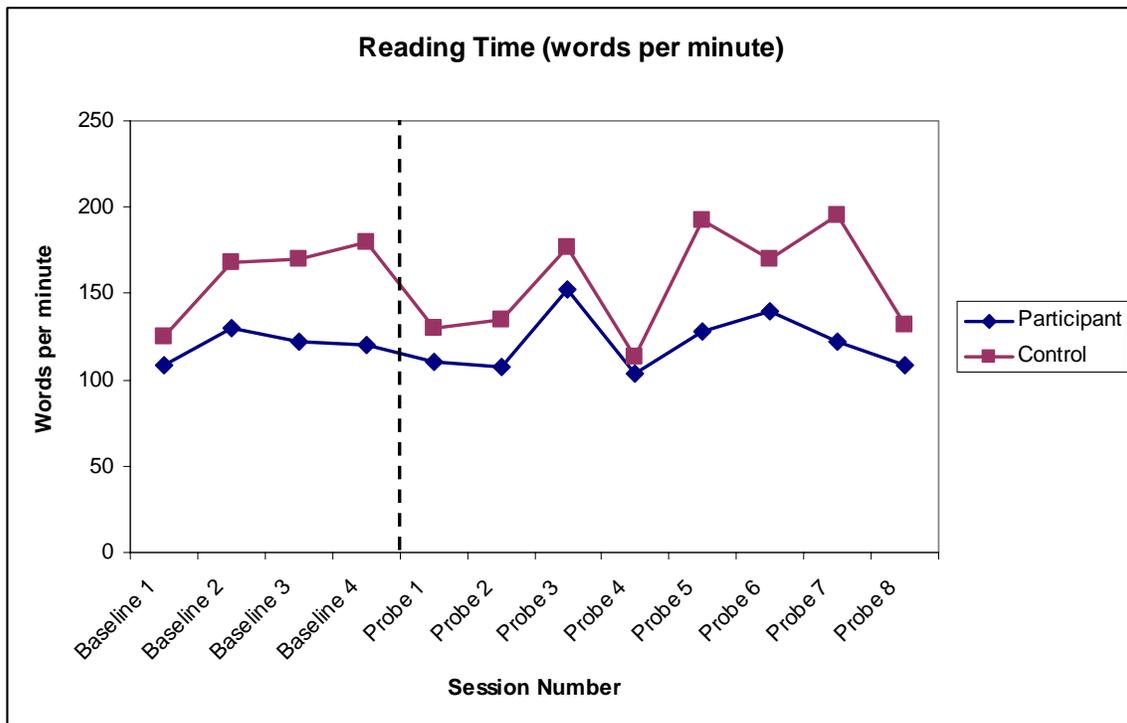


Figure 1. Treatment probe data for reading rate for baseline and treatment sessions.

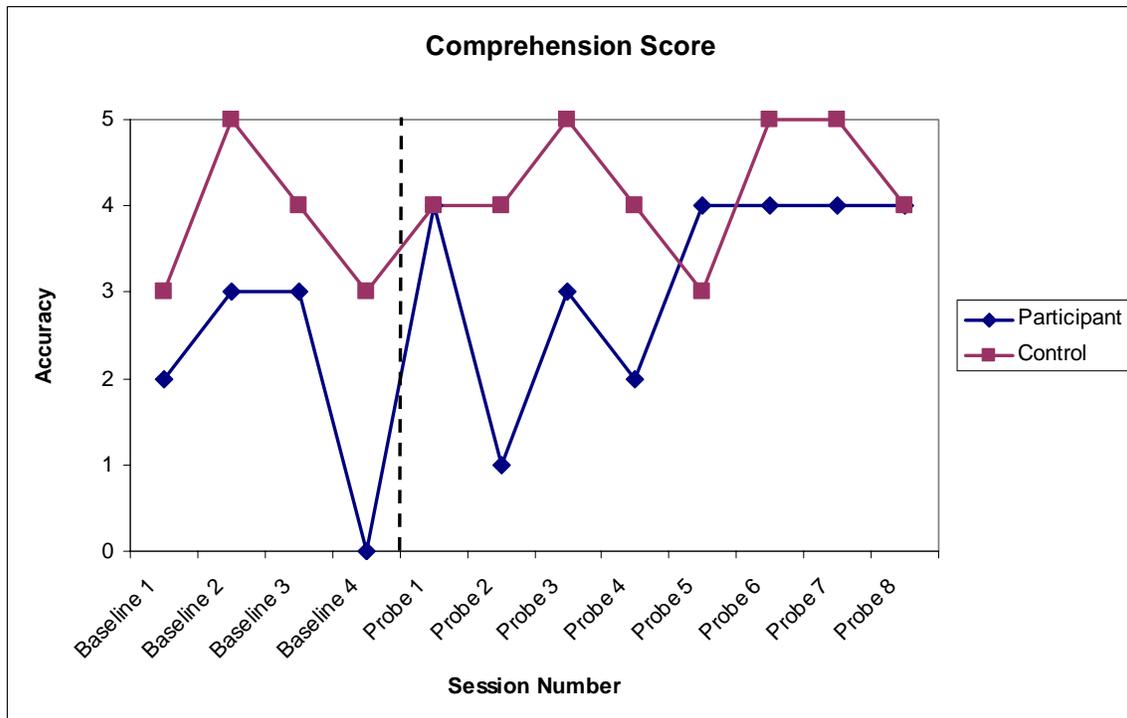


Figure 2. Treatment probe data for reading comprehension for baseline and treatment sessions.

Table 1. Pre- and Post-treatment formal test scores

<i>Test</i>	<i>Pre-treatment</i>	<i>Post-treatment</i>
WAB-AQ	91.9	96.6
GORT-4		
Rate	45/70	49/70
Accuracy	65/70	69/70
Fluency	110/140	118/140
Comprehension	61/70	58/70
TEA		
Map Search 1	24	42
Map Search 2	46	74
Elevator Counting	6	7
Elev. Count-Distracton	4	10
Visual Elevator 1	10	10
Visual Elevator 2	3.7	3.8
Elev. Count-Reversal	2	5
Telephone Search	4.9	3.65
Tel. Search-Counting	0.1	0.75
Lottery	9	9

Table 2. Pre- and Post-treatment responses from *Attention Process Training-II Questionnaire*.

<i>Question</i>	<i>Pre-treatment response</i>	<i>Post-treatment response</i>
1. Seem to lack mental energy to do activities.	On occasion	On occasion
2. Am slow to respond when asked a question or when participating in conversations.	Not a problem	Not a problem
3. Can't keep mind on activity or thought because mind keeps wandering.	Sometimes	On occasion
4. Can't keep mind on activity or thought because mind feels "spacey" or "blank".	On occasion	Not a problem
5. Can only concentrate for short periods of time.	Frequently	Sometimes
6. Miss details or make mistakes because level of concentration decreased.	Sometimes	On occasion
7. Easily get off track if other people milling about nearby.	Sometimes	Sometimes
8. Easily distracted by surrounding noise.	Frequently	Sometimes
9. Trouble paying attention to conversation, if more than one other person.	Frequently	Sometimes
10. Easily lose place if task or thinking interrupted.	On occasion	On occasion
11. Easily overwhelmed if task has several components.	On occasion	On occasion
12. Difficult to pay attention to more than one things at a time.	Sometimes	On occasion