ORIGINAL ARTICLE

Patient-Reported Changes in Communication After Computer-Based Script Training for Aphasia

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ABSTRACT. Manheim LM, Halper AS, Cherney L. Patient-reported changes in communication after computer-based script training for aphasia. Arch Phys Med Rehabil 2009;90:623-7.

Objective: To evaluate changes in patient-reported communication difficulty after a home-based, computer-delivered intervention designed to improve conversational skills in adults with aphasia.

Design: Delayed treatment design with baseline, preintervention, postintervention, and follow-up observations.

Setting: Outpatient rehabilitation.

Participants: Twenty subjects with chronic aphasia.

Interventions: Sessions with the speech-language pathologist to develop personally relevant conversational scripts, followed by 9 weeks of intensive home practice using a computer program loaded on a laptop, and weekly monitoring visits with the speech-language pathologist.

Main Outcome Measure: Communication Difficulty (CD) subscale of the Burden of Stroke Scale (BOSS).

Results: The intervention resulted in a statistically and clinically significant decrease of 6.79 points (P=.038) in the CD subscale of the BOSS during the intervention, maintained during the follow-up period.

Conclusions: The findings of this study provide positive albeit preliminary and limited support for the use of a home-based, computer-delivered language intervention program for improving patient-reported communication outcomes in adults with chronic aphasia. Additional research will be required to examine the efficacy and effectiveness of this intervention.

Key Words: Aphasia; Communication; Computer-assisted instruction; Cost, cost analysis; Rehabilitation.

IT HAS BEEN ESTIMATED that that there are more than 5 million stroke survivors in the United States,[1] 33% of whom have some impairment in language.[2] Thus, more than a million people are living with aphasia in the United States alone.[3] Although meta-analyses[4,5] and expert opinion[6,7] indicate that individuals with aphasia benefit from treatments that improve linguistic skills, residual communication problems generally continue to have a substantial impact on their daily lives. Therefore, treatments that focus on improving their ability to participate in daily activities have received increased attention.[8] Therapeutic interventions for aphasia are concentrated during the acute stage. Yet reacquisition of communication skills often requires long-term effort and training, generally not well supported by insurance during the chronic stage of the condition. A program that uses computer treatment as a medium for therapy and emphasizes the development of conversational skills may provide an important and low-cost means of reintegration into some of the normal activities of daily living.

Scripts can facilitate participation in personally relevant activities by guiding individual communication actions involved in a social situation.[9,10] Script training is designed to help speakers with aphasia use short self-chosen monologues and dialogues in natural, conversational contexts. During training, scripts are developed by the person with aphasia, with assistance from the speech-language pathologist. Cue-based massed drilling of the entire script is required to facilitate less effortful script production. This massed practice and drill can be accomplished in a low-cost manner by using computers.

There is an existing and well documented body of literature to support the positive effects of computer treatment for people confronting the long-term effects of aphasia.[11,12] Current computer programs for aphasia typically focus on tasks at the single-word level, including verbal and written word finding, single-word auditory comprehension skills, and single-word visual recognition and reading comprehension.[13-18] However, Petheram[19] has noted that retrieving a word in response to a picture during treatment is not comparable to retrieving the same word in everyday conversation. We present a computer program that, instead of working on single-word tasks, provides a more realistic conversational context for practicing language skills.[20]

We evaluate the impact of the program protocol in reducing patient-reported communication difficulty as measured by the CD subscale from the BOSS.[21-23] We then discuss the potential costs and cost savings of the computerized script training program when used in conjunction with speech and language therapy.

METHODS

Subjects

Twenty-five subjects were recruited with aphasia subsequent to a left-hemisphere stroke confirmed by medical history and computerized tomography or magnetic resonance imaging. Subjects

List of Abbreviations

BDAE	Boston Diagnostic Aphasia Examination
BOSS	Burden of Stroke Scale
CD	Communication Difficulty

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were at least 6 months poststroke and right-hand dominant, with no history of other premorbid neurologic or psychiatric disorders. They had completed at least 10th grade and were literate in English before their strokes. Visual acuity was no worse than 20/100 corrected in the better eye; auditory acuity was no worse than 30 dB hearing level at 500, 1000, and 2000 Hz, aided in the better ear. Subjects did not receive any other individual or group treatment while they were participating in this study. All subjects provided written informed consent under the approval of the Northwestern University Institutional Review Board.

Study Design

A delayed treatment design was used in which subjects' outcomes were measured at 4 separate times: (1) at entry into the study (baseline), (2) approximately 6 weeks later at the start of the intervention (pretreatment), (3) at the end of the intervention (posttreatment), and (4) at a retest planned to occur at approximately 6 weeks after the end of the intervention (follow-up).

Intervention

The intervention involved a computer-based script training program called AphasiaScripts, which was developed as part of a research study. In AphasiaScripts, an avatar that is programmed to produce natural speech with correct movements of the speech articulators serves as a virtual therapist.[20] Prior to treatment, the individual with aphasia and the speech-language pathologist work together to develop individualized scripts on a topic that is meaningful and relevant. After a script has been developed, it is typed into the program and recorded by the speech-language pathologist. Using AphasiaScripts, the individual with aphasia has repeated opportunities to practice the recorded conversations. Script practice has 3 phases. First, the subject listens to the entire script while it appears on the screen. Second, each sentence or conversation turn is practiced repeatedly. Third, the conversation is practiced with the virtual therapist while various forms of assistance are provided, depending on the subject's needs. These include seeing the written word, hearing the therapist's voice during choral speaking, and watching oral-motor movements of the virtual therapist. These cues are faded over time so that eventually the subject practices the conversation with the virtual therapist, without cues, as in a real conversation.[20]

In this study, subjects worked with the speech-language pathologist to develop 3 scripts. Script development occurred over a period of 5 sessions. Then each script was practiced consecutively for 3 weeks for a total of 9 weeks of intervention. The protocol suggested that participants practice the script daily for at least 30 minutes at home on a loaned laptop. Participants kept a paper-and-pencil log of their practice times. In addition, the computer program maintained an objective measure of practice times based on log-on and log-off times as well as keystrokes made during the practice session. During the 9 weeks of practice, the subject with aphasia met once a week with a speech-language pathologist only to check status and ensure compliance. Because of differences in scheduling appointments during script development, there was variability in the length of time between pretreatment and posttreatment testing. However, the intervention was always 9 weeks.

Measurement of Outcomes

To measure patient-reported communication difficulty, we selected the CD subscale of the BOSS. The BOSS is a comprehensive, patient-reported measure of functioning and well being.[22] It is a 64-item scale made up of 12 internally consistent and unidimensional scales. The CD subscale consists of 7 items: "Because of your stroke, how difficult is it for you to (1) talk, (2) understand what people say to you, (3) understand what you read, (4) write a letter, (5) talk with a group of people, (6) be understood by others, and (7) find the words you want to say?" Responses to each item use a 5-point scale, from *not at all* to *cannot do*. We also examined 2 other subscales from the BOSS: (1) the 3-item Communication-Associated Psychological Distress subscale, intended to measure patient-reported mood, satisfaction, and normal activity restriction caused by difficulties with communicating; and (2) the Mobility subscale, which consists of 5 items that measure patient-reported mobility. All testing was conducted by a speech-language pathologist who was independent of the treating speech-language pathologist.

Analysis

We estimated 3 fixed-effects linear regressions, which control for both within-person correlation of repeated observations and for average differences in CD scores across persons,[24] with the outcome scores (CD, Communication-Associated Psychological Distress, Mobility) as the dependent variables in each regression. Each subject had repeated outcome measurements at the 4 times they were asked to complete the BOSS. The regression coefficients measure the mean outcome score at the preintervention period and then the difference in scores between the preintervention period at each of the other 3 observation points. We also calculated the effect sizes based on Cohen *d* score, defined as the difference between the means divided by the SD of either group. Cohen equates values of .2, .5, and .8 as small, medium, and large effect sizes, respectively.[25]

Responses on each of the BOSS individual self-reported items can take a value of 0 to 4. The individual scores were summed, and a transformed scale score was constructed, equal to [(actual score minus lowest possible score) divided by possible score range] multiplied by 100. This transformed scale can have values ranging from 0 (no difficulty) to 100 (cannot do).[23] A lower score on this and the other BOSS subscales denotes improved function.

Our primary hypotheses were that for the CD score, we would find the statistically significant negative (improved) change in CD scores between the preintervention and 2 postintervention measures, but no change in CD between the baseline and preintervention period. For the BOSS mobility subscale score, we expected to find no statistically significant changes because of the intervention. As a sensitivity analysis, we examined whether any of the other BOSS subscales had statistically significant changes in outcomes during the intervention period using the same fixed effects regression framework. For all tests of hypotheses, we used a 2-tailed significance test against the null hypothesis of no effect.

RESULTS

The first 25 subjects entered into the study formed the sample. However, data from 5 subjects could not be analyzed because they did not have 2 test sessions prior to the intervention (baseline and preintervention), and at least 1 test session postintervention. Of the 20 subjects included in the analyses, 3 did not have the follow-up interview at 6 weeks postintervention.

The 20 subjects (13 men) were 26 to 78 years of age (mean, 54.80; SD±15.25) with an education level that ranged from 10 to 22 years (mean, 15.06; SD±3.24). The time since the onset