BACKGROUND

Evidence suggests that constraint-induced language therapy (CILT) is an effective treatment for improving naming in some individuals with chronic aphasia. Unlike traditional therapy approaches in aphasia rehabilitation, CILT incorporates massed practice, constrains all modes of communication except speech, and forces use of spoken language in relevant communication exchanges. CILT's repetitive nature and forced speech has yielded significant improvements on naming tasks and standardized clinical measurements in some patients (Maher et al., 2006; Pulvermüller et al., 2001). To date, however, most gains from CILT have been demonstrated in patients whose severity was reported as mild or moderate (Cherney et al., 2008).

Difficulties with expressive language in individuals with aphasia may be exacerbated by apraxia of speech (AOS), a motor programming deficit often resulting from left hemisphere stroke. Individuals with AOS exhibit deficits in motor execution in the absence of muscular weakness. Characterized by slow, groping speech and frequent articulatory errors, AOS often occurs in the presence of aphasia (McNeil et al., 2009). Although severe AOS may negatively impact verbal output and response to treatment, at least one patient with severe AOS was reported to have demonstrated meaningful language improvements following CILT (Maher et al., 2006).

The purpose of this study was to compare the treatment effects of CILT versus a more traditional approach to aphasia rehabilitation in two participants with chronic severe expressive aphasia and AOS. It was hypothesized that target words trained using the CILT approach would be named with greater accuracy and maintained longer than targets trained using a modified version of Promoting Aphasics' Communicative Effectiveness (PACE; Davis & Wilcox, 1985).

METHODS

Participants:

HBL was a 71-year old English-speaking male, nine years post-onset of a single left CVA. A structural T1-weighted MRI scan revealed lesion in cortex and subjacent white matter predominantly in the left frontal lobe, including most of Broca's area, the insula, and subcortical structures, e.g., basal ganglia (Figure 1). He was classified as having moderate-to-severe transcortical motor aphasia as indicated by his performance on subtests of the Boston Diagnostic Aphasia Examination (BDAE; Goodglass, Kaplan, & Barresi, 2001): 80th percentile on the mean of three auditory comprehension tasks; 9/10 on word repetition; 8/10 on sentence repetition; and 32/60 on the Boston Naming Test (BNT; Kaplan et al., 2001). His conversational speech was generally limited to 1-2 word responses, often ending with "*I can't say*". According to the Apraxia Battery for Adults, 2nd Ed. (ABA-2; Dabul, 2000), he was classified as having moderate AOS.

ITY was a 79-year old English-speaking female, six months post-onset of a single left CVA. A structural T1-weighted MRI scan revealed lesion predominantly in cortex and subjacent white matter, predominantly in the left frontal lobe, including most of Broca's area, the insula, and subcortical structures, e.g., basal ganglia (Figure 2). She was classified as having moderate-severe Broca's aphasia as indicated by her performance on subtests of the BDAE: 60th percentile on the mean of three auditory comprehension tasks; 5/10 on word repetition; 2/10 on sentence repetition; and 24/60 on the BNT. According to the ABA-2, she was classified as having moderate-severe AOS.

Procedure:

HBL and ITY participated in two phases of intensive naming treatment. Participants were treated in a dyadic setting by two graduate students and a licensed SLP. Treatment phase one was a modified version of PACE (Davis & Wilcox, 1985); phase two utilized methods of Constraint Induced Language Therapy (CILT; Pulvermüller et al., 2001). Participants did not receive any other speech and language therapy during either treatment phase. Both PACE and CILT treatment periods were of equal intensity: three hours/day, five days/week, for two weeks.

Treatment in both phases consisted of structured, repetitive card games, which required participants to request an action or an object depicted by black and white line drawings on laminated playing cards. During the PACE treatment phase, participants were able to request cards using any mode of communication, including but not limited to speech, gestures, drawing, writing, or naming a related object or action. If the participant used an alternative mode of communication, the clinician or graduate student clinician provided the name of the object in her response (e.g. "Yes, I have the *pineapple*"; "No, I don't have *plowing*"). During the CILT treatment phase, acceptable responses were constrained to speech.

Target pictures were selected after three sessions of baseline confrontational naming of a large database of common objects and actions (Szekeley et al., 2005). Pictures consistently missed by both participants were chosen as treatment targets and divided into three sets of 48 words (24 actions, 24 objects): PACE, CILT, and an untrained (UNTR) control set. A fourth set was comprised of pictures each participant accurately named 3/3 times during baseline testing. The word lists were matched for visual complexity, familiarity, word frequency, and number of syllables and letters. Participants were probed on trained and untrained targets three times a week during treatment.

RESULTS

HBL made notable gains in naming trained targets during both PACE and CILT treatment phases, more quickly and with greater accuracy for CILT than PACE (Figure 3). His pre/post-treatment BDAE scores did not improve.

ITY's naming also improved, more quickly for CILT than PACE (Figure 4). Her gains were weaker and less stable than those of HBL, although she made meaningful improvements on the BNT (pre:24/60; post-PACE:23/60; post-CILT:33/60) and Responsive Naming subtest of the BDAE (pre: 6/20; post-PACE: 6/20; post-CILT: 11/20) following CILT.

DISCUSSION

Results of this study suggest that both CILT and intensive, short-term PACE therapy can improve naming ability even in chronic moderate to severe aphasia with co-morbid AOS. HBL and ITY accurately produced more target words treated with CILT than those treated with

PACE, supporting the notion that the intense and repetitive nature of obligatory speech production in CILT has a positive effect on word retrieval. Both participants will be re-tested next month, and we expect the 6-months maintenance of CILT targets to exceed that of PACE.

Although both participants received the same exposure to target words, HBL made more gains in naming than ITY. We attribute the discrepancy between participants' success in therapy to their differing severity levels of AOS. ITY, who was diagnosed with moderate-severe AOS, was self-conscious of her speech errors and the difficulty she experienced correcting them. She demonstrated frustration and fatigue after attempts at naming, and seemed to need more positive reinforcement than HBL. Due to the length of time it took to produce an accurate name, she was not likely to repeat a target without prompting. In spite of moderate AOS, HBL was able to accurately produce words after receiving a verbal and visual model. Following an accurate production, he invariably repeated it one or more times. In fact, he voluntarily produced the names of pictures during ITY's turn, sometimes modeling the production for her. Thus, HBL simply received more practice than ITY accurately naming pictures.

Cherney and colleagues (2008) concluded that more studies are needed to tease apart the impact of constraint and intensity of treatment outcome. Studies will also need to determine how factors such as severity of aphasia and co-morbid AOS might influence client appropriateness for these intensive treatment programs. Ultimately, randomized studies with larger samples will be required to definitively address these issues along with questions of optimum dosage.

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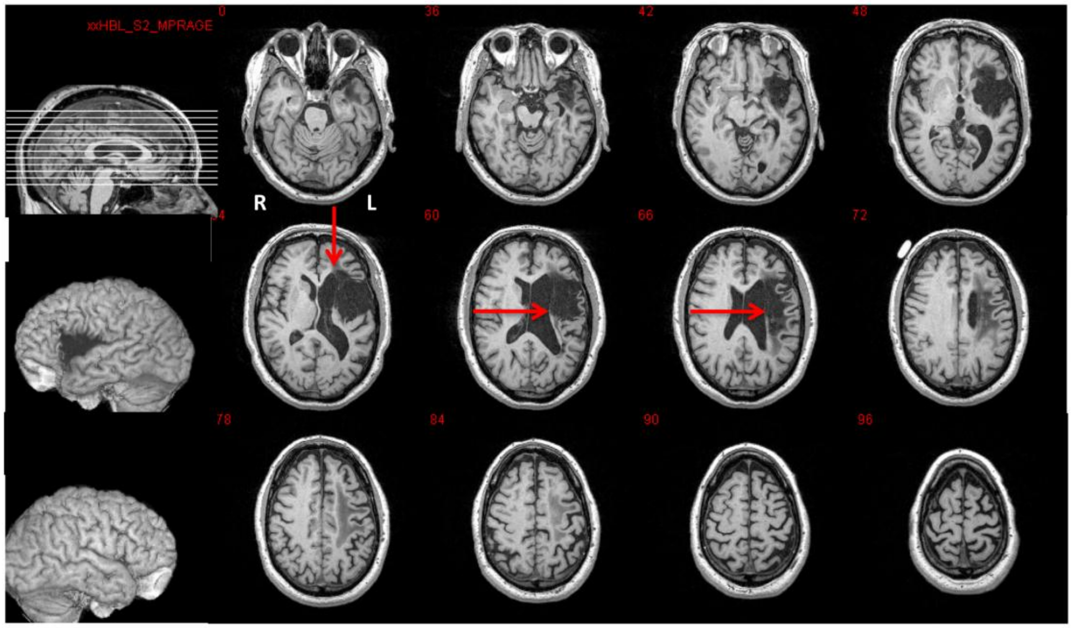

Figure 1. Structural T1-weighted MRI scan for participant HBL. Lesion present in cortex and subjacent white matter (WM) predominantly in left frontal lobe, including most of Broca's area, the insula, motor/sensory (mouth), with extension into portions of the inf parietal lobule, supramarginal and angular gyri, temporal pole and planum temporal; lesion also extended into the basal ganglia and thalamus. Lesion was also noted in the medial scF and middle 1/3 periventricular WM (red arrows), two regions known to be compatible with severe nonfluent speech (Naeser et al., 1989).

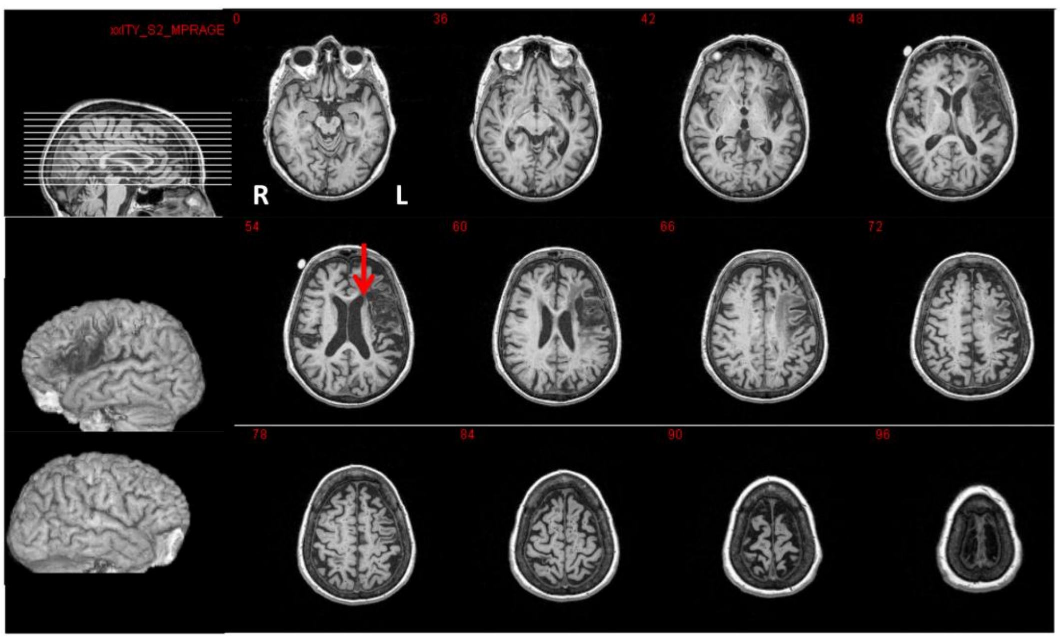

Figure 2. Structural T1-weighted MRI scan for participant ITY. Lesion present in cortex and subjacent white matter (WM) predominantly in left frontal lobe, including most of Broca's area, the insula, motor/sensory (mouth and hand), inf MFG, with extension into portions of the supramarginal and angular gyri, and planum temporal; lesion extended into the basal ganglia and was also noted in the medial scF (red arrow), one of two regions known to be compatible with severe nonfluent speech (Naeser et al., 1989). Some white matter lesion and lacunar infarcts along with general bilateral cortical atrophy associated with aging was noted.

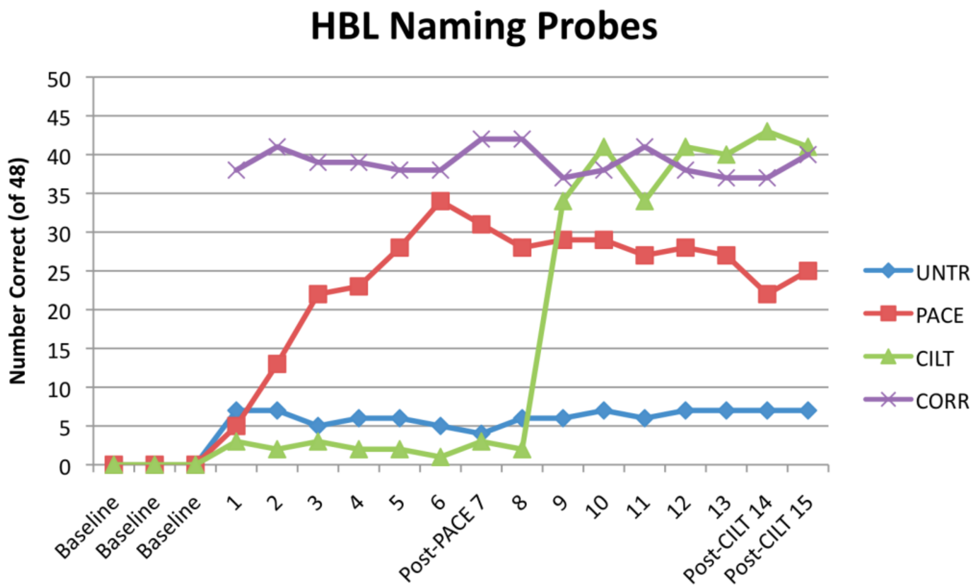

Figure 3. HBL's picture naming accuracy during probes for trained PACE, trained CILT, untrained (UNTR), and consistently correct (CORR) items. Each set of 48 words contained 24 picturable actions and 24 common objects (Szekeley et al., 2005).

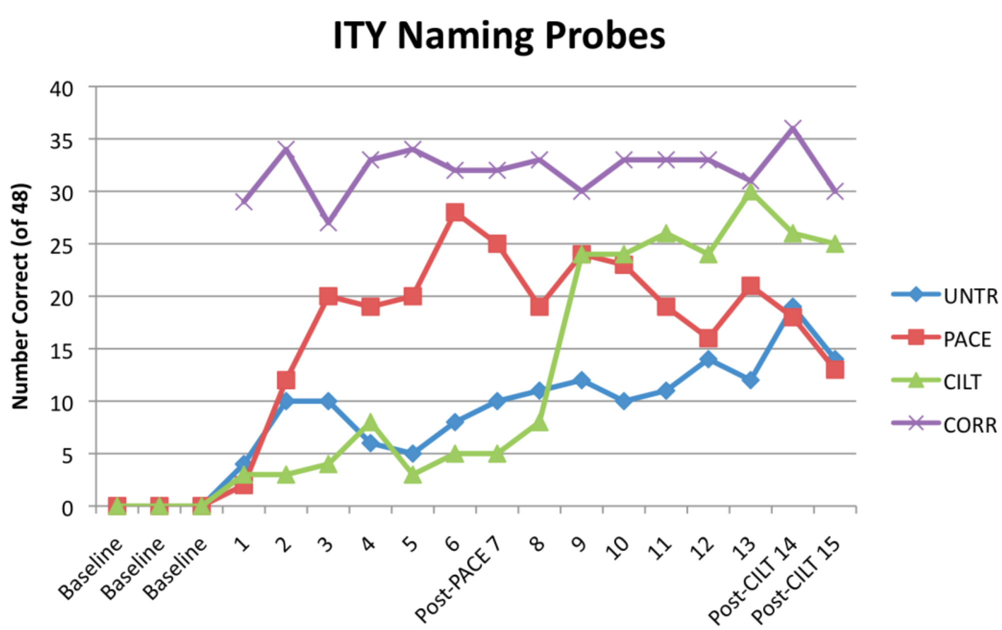

Figure 4. ITY's picture naming accuracy during probes for trained PACE, trained CILT, untrained (UNTR), and consistently correct (CORR) items. Each set of 48 words contained 24 picturable actions and 24 common objects (Szekeley et al., 2005).