

## INTRODUCTION

Constraint-Induced Aphasia Therapy (CIAT) is an intensive intervention procedure for individuals attempting to recover communication functionality after stroke. Modeled on procedures used to facilitate recovery of motor function (Taub, Uswatte and Piclikiti, 1999), CIAT utilizes techniques that focus on maximally challenging activities and increased treatment intensity while constraining use of compensatory strategies. Anecdotally, patients who participate in CIAT have been noted to demonstrate improvement of their conversational abilities, but most reports have focused on formal test data and/or restricted therapy methods (e.g. Pulvermuller, Meininger, Elbert, Mohr, Rockstroh, Koebbel, and Taub, 2001). Additionally, overall functional communicative effectiveness is routinely reported by clients and family and caregivers to have improved after a course of CIAT even while results of standardized tests (e.g. the subtests of the *Boston Diagnostic Aphasia Examination* (BDAE; Goodglass, Kaplan, and Barresi, 2001) do not show a significant change. This study is a pilot using discourse analysis to evaluate changes in the conversational abilities of patients who have participated in the CIAT program and a comparison of those changes to the standardized test results (using BDAE subtests) obtained during pre-and post-treatment testing. Two participants are included here. Additional participants will be added as they complete their courses of CIAT.

## SUBJECTS

Subject 1, a 67 year-old man, was seen 5 years, 11 months after a left-hemisphere stroke. No specific information regarding initial classification of aphasia type or site of lesion was available. He reported years of speech therapy following his stroke, with some improvement in communication skills. He had not had speech therapy for 2 years prior to enrollment in the CIAT program.

Subject 2, a 69 year-old man, was enrolled in a CIAT program 2 years and 11 months after a stroke. Neurological damage was thought to be related to a carotid artery dissection in the left hemisphere with subsequent thrombosis. Subject 2 presented with mild Broca's aphasia, with repetition and spontaneous speech mildly impaired. He also had frequent word-finding difficulty as well as extensive circumlocution during spontaneous speech. He reported ongoing traditional speech therapy at the time of CIAT. Previously, he participated in 2 weeks of CIAT therapy in July of 2006, and 4 weeks of intensive speech therapy not classified as CIAT in June of 2007. Information presented here was gathered during his second course of CIAT.

## TREATMENT

Treatment was provided using the Aphasia Rehabilitation with Re-learning using Constraint Principles (ARRC-P) protocol based on constraint-induced movement therapy principles. The treatment protocol included 3.5 hours of treatment, 5 days per week for 2 weeks (10 total session), with one 30-minute break provided each day. Standard therapeutic activities targeting functional verbalization were used. However, activities were modified to be at a "significantly challenging level", or at a level where adequate

responses could be achieved independently approximately 50% of the time within 2-3 minutes. The therapist provided only minimal feedback to alert client to revise a response. The subject's initial attempt was allowed to continue up to the point at which it was felt that the patient could no longer progress independently toward a correct response; at that point, successively more informative cues were provided until an accurate response was achieved. Once the accurate response was achieved, the clinician repeated the accurate response and the conversation resumed. Therapy sessions included additional structured activities targeting mental flexibility and higher-level word finding, with the same cueing restrictions during initial responses.

## ASSESSMENT

Assessment of each subject was completed at the initial session, before beginning CIAT, and again after the course of therapy.

Formal Testing: Subtests of the BDAE were administered. Subject 1 completed the short form and Subject 2 completed the long form.

Discourse Analysis: Conversation samples from the initial and final assessment sessions were analyzed for specific discourse skills that either "facilitated" or "inhibited" the discourse. Two judges independently transcribed the samples with an agreement rating of 98%. Each sample was coded independently, with coding scores reflecting a consensus between the coders and the second author. The discourse characteristics included in this study were:

1. Discourse "facilitating" characteristics: aspects of discourse which facilitate information flow, contribute to the verbal sophistication of the interaction, etc., including:
  - a. Topic-related skills utterances with appropriate introduction of topic, or elaboration on an existing topic
  - b. Informativeness: utterances which were understandable, complete, and added information to the conversation
  - c. Cohesion: utterances with linked referencing, temporal and/or clausal cohesion
  - d. Use of conversation markers: Including overt markers of new information, overt repair or apology for confusing information, and /or narrative/story telling markers
  - e. Syntactic complexity: including sentences in the passive voice, with relative or infinitival clauses, or topicalization
2. Discourse "inhibiting" characteristics: those aspects of discourse which inhibit (or completely impede) conversation and information flow, including:
  - a. Noninformativeness: including empty words, perseverations, paraphasias, pronouns without a clear referent, verbosity, or unnecessary repetition of information. Note that utterances can contain both informative and noninformative elements: these are not mutually exclusive codes
  - b. Nonfluency: including overt word-finding difficulty, unnecessary pauses, and/or repetition of words or syllables

- c. No response: including lack of response and unrelated/inappropriate responses

## RESULTS

Results are presented below in Tables 1 through 3 (note: percentages are rounded up to the closest whole number). BDAE sub-sections were primarily chosen from the Rating Scale Profile of Speech Characteristics due to the relative comparability of these ratings to the discourse analysis characteristics.

First, standardized test data is presented for the two patients below in Table 1. Since Subject 1 completed the short form, some subtests are not reported.

Table 1: Change in Percentile Rank on Standard Subtests (Shaded cells indicate increased percentile rank)

	Subject 1	Subject 2
	Change in Percentile Rank pre- vs. post-test	
Subtest		
Severity Rating	+30	+10
Fluency-Phrase Length	0 (100 <sup>th</sup> %ile)	+30
Fluency-Melodic Line	0 (100 <sup>th</sup> %ile)	0 (90 <sup>th</sup> %ile)
Fluency-Grammatical Form	+20	+20
Conversation-simple social responses	0 (100 <sup>th</sup> %ile)	+19
Conversation-Complexity Index	n/a	+5
Auditory Comprehension-Basic word Discrimination	0 (100 <sup>th</sup> %ile)	0 (40 <sup>th</sup> %ile)
Auditory Comprehension-Commands	0 (100 <sup>th</sup> %ile)	+10
Auditory Comprehension-Complex Ideational Material	+30	+10
Articulation-non-verbal agility	n/a	+15
Articulation-verbal agility	n/a	+30
Articulation-articulatory agility	0 (100 <sup>th</sup> %ile)	+5
Recitation and Music-Automatized Sequences	0 (100 <sup>th</sup> %ile)	0 (70 <sup>th</sup> %ile)
Recitation and Music-Recitation	n/a	0 (30 <sup>th</sup> %ile)
Repetition-words	0 (100 <sup>th</sup> %ile)	+10
Repetition-Sentences	+40	0 (30 <sup>th</sup> %ile)
Naming-responsive naming	0 (100 <sup>th</sup> %ile)	0 (50 <sup>th</sup> %ile)
Naming-Boston Naming Test	0 (100 <sup>th</sup> %ile)	0 (40 <sup>th</sup> %ile)
Paraphasia Rating	+30	+10
Reading-oral sentence reading	0 (100 <sup>th</sup> %ile)	0 (90 <sup>th</sup> %ile)
Reading-oral sentence comprehension	-40	0 (50 <sup>th</sup> %ile)
Writing-form	-50	0 (100 <sup>th</sup> %ile)
Writing-letter choice	0 (100 <sup>th</sup> %ile)	0 (100 <sup>th</sup> %ile)
Writing-motor facility	+10	0 (100 <sup>th</sup> %ile)
Writing-primer words	0 (100 <sup>th</sup> %ile)	0 (100 <sup>th</sup> %ile)

Writing-regular phonics	0 (50 <sup>th</sup> %ile)	0 (70 <sup>th</sup> %ile)
Writing-common irregular words	0 (60 <sup>th</sup> %ile)	+10
Writing-written picture naming	0 (50 <sup>h</sup> %ile)	0 (30 <sup>th</sup> %ile)
Writing-narrative writing	0 (60 <sup>th</sup> %ile)	+20

As seen below, discourse structuring skills did not improve “as a piece”; rather, individual characteristics showed differing patterns of increase or decrease and often, most closely related BDAE measures did not agree with the discourse structure findings.

Table 2—Subject 1 Comparative Change (BDAE Short Form Completed) (items in shaded boxes represent at least 10 point change in both areas)

Discourse Element	% Change	Most Closely Related BDAE Measure(s)	Change in BDAE score
<b>Facilitating Characteristics</b>			
Topic Element	+29%	Paraphasia in running speech	+30%ile points
		Boston Naming Test	No change ***
		Conversation/Simple Social Responses	No change
Informativeness	+26%	Paraphasia in running speech	+30%ile points
		Phrase Length	No change
Cohesion	-18%	Grammatical Form	+20%ile points
Conversation Markers	-10%	Grammatical Form	+20%ile points
Syntactic Complexity	-1%	Grammatical Form	+20%ile points
<b>Inhibiting Characteristics</b>			
Noninformativeness	-32%	Paraphasia in running speech	+30%ile points
		Word finding relative to fluency	+2 scale points
Nonfluent	+7%	Phrase Length	No change
No response	-3%	Paraphasia in running speech	+30

\*\*\*No change in number of correct responses, however, the speed at which those responses were produced did demonstrate a 13 second decrease on average for delayed responses

Table 3—Subject 2 Comparative Change (BADE Standard Form Completed) (items in bolded boxes represent at least 10 point change in both areas)

Discourse Element	% Change	Most Closely Related BDAE Measure	Change in BDAE score
<b>Facilitating Characteristics</b>			
Topic Element	+26%	Conversation/Simple Social Responses	+10%ile points
		Paraphasia in running speech	+10%ile points
		Boston Naming Text	No change

Informativeness	+14%	Paraphasia in running speech	+10%ile points
		Phrase Length	+40%ile points
Cohesion	+1%	Complexity Index	+5%ile points
		Grammatical Form	
Conversation Markers	-1%	Complexity Index	+5%ile points
Syntactic Complexity	+8%	Complexity Index	+5%ile points
		Grammatical Form	+20%ile points
<b>Inhibiting Characteristics</b>			
Noninformativeness	-33%	Complexity Index—Empty Utterances	No change
		Paraphasias in running speech	+10%ile points
Nonfluent	-15%	Phrase Length	+40%ile points
No response	+2%	Paraphasias in running speech	+10%ile points
		Complexity Index—Empty Utterances	No change

The greatest increases in the “discourse facilitating” category were in the use of topic-related skills and in informativeness. These two categories also corresponded most consistently with the most closely related subtests on the BDAE. “Paraphasias in running speech” appeared to be the most closely related of all compared subtests. The “after” samples can be characterized as having longer exchanges (more utterances) related to a single topic, with utterances also advancing the conversation by being informative. There were fewer conversational markers in the second samples, perhaps also due to the greater number of utterances which continued a topic and did not need to be marked in any unusual manner. With regard to the discourse inhibiting characteristics, there was a notable decrease in noninformative utterances, and a slight increase in nonfluent utterances, suggesting that the latter is not crucial to overall information flow.

## SUMMARY

The results from these two participants suggest that the CIAT protocol resulted in measurable changes in skills related to discourse structure for these cases, substantiating the anecdotal impressions of family and patients. Further, as seen in previous research on efficacy of treatment for individuals with aphasia, (e.g. McCullough, 2006; Marini, Caltagirone, Pasqualetti and Carlomango, 2007), the improvement seen after participation in CIAT may best be evaluated by analysis of discourse abilities since those changes were not always reflected in their standardized test scores (at least when the standardized measure was the BDAE). We look forward to expanding this research with the larger group of subjects participating in CIAT sessions.

## REFERENCES

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