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Movement from Global to Broca's Aphasia in the Chronic Stage: Who Moves, and How?

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Lingraphica

Abstract

We analyze WAB (impairment level) and CETI (functional level) assessment data for twenty persons in chronic global aphasia who used a Speech Generating Device at home for therapy and communication. We use matched *t*-tests to determine magnitude and significance of differences of means following SGD use, and one-way ANOVAs to compare those who moved to Broca's aphasia following use versus those who didn't. Data analyses reveal that the two groups show very similar patterns of improvement overall after SGD use. However, on a few key items, they differ significantly: we identify these, report difference particulars, and discuss implications.

Research Description

In a 1999 article in the journal *Stroke*, analysis of data from 46 persons in chronic aphasia showed that – across the range of diagnostic categories of aphasia – not only did subjects show significant quantitative improvements in all measures assessed following Speech Generating Device (SGD) use, but that a substantial minority – approximately 37% – evolved to less severe diagnostic categories of aphasia, with correspondingly greater than mean improvements registered.¹ In this paper, we examine a larger data set from a single diagnostic category, chronic global aphasia.

Methods

Subjects

Subjects were patients diagnosed with aphasia who were participants in aphasia rehabilitation programs using the Lingraphica SGD. Subjects used the SGD in scheduled treatment and training sessions with Speech Language Pathologists, and also took them home between those sessions for completion of assigned exercises, for use in supporting communication, for practice and exploration, and for other uses of interest to them. To qualify for inclusion in this study, subjects had to meet four program criteria: i) assignment at Intake to one of the diagnostic categories of aphasia by the *Western Aphasia Battery* (WAB);^{2,3} ii) completion of at least one month of program participation; iii) assessment at intake and discharge using the language subtests from the WAB; and iv) assessment at

intake and discharge using the sixteen items of the *Communicative Effectiveness Index* (CETI).⁴ Twenty patients meeting these four criteria, who were also at least six months post-onset an intake and were assigned following WAB administration at intake to the diagnostic category of global aphasia, comprise the sample of this study. Demographic, diagnostic, and treatment characteristics of the subject sample are presented in Table 1.

Treatment

The aphasia rehabilitation programs, the SGD used in it, and participant benefits and outcome improvements are described elsewhere.⁵⁻¹⁰ Generally during treatment sessions, subjects and clinicians used the portable computer-based system for material presentation and interaction, then between sessions subjects took their systems home to complete assigned exercises, to explore, practice, rehearse on their own, and to facilitate functional communication. Program participation continued as long as significant functional improvement could be documented monthly; then subjects were discharged. Mean duration of program participation was 20.6 weeks, with a mean frequency of 2.0 sessions/week.

Tests

WAB language subtests were administered by the SLP clinicians to all subjects at intake and at discharge. CETI ratings were completed at intake and discharge by family members or close friends. All testing and ratings were all done in standard ways, absent the SGD technology, with the goal of assessing subjects' unaided impairment-level and functional-level performances.

Data Analysis

Using raw WAB scores, derived WAB Aphasia Quotients (AQs), and raw CETI scores, we calculated and compared pre-treatment and post-treatment means with one-tailed, matched *t*-tests to establish statistical significance of differences of means. We then used one-way ANOVAs to compare items at intake, during participation, and at discharge, to characterize significant differences between two sub-groups – (i) Gl:Gl, comprising 12 subjects who received WAB assignment to global aphasia at intake and discharge both, and (ii) Gl:Br, comprising 8 subjects who received WAB assignment to global aphasia at intake but to Broca's aphasia at discharge. Level for rejection of the Null Hypothesis was set at $p = .05$.¹¹

Results

For the overall sample of 20 subjects, analysis of WAB data shows significant improvement ($p < .05$) in the AQ and in two language subtests, namely Auditory Verbal Comprehension (AVC) and Naming. Table 2 provides details, with initial and final mean scores, differences of those means, standard deviations, and the associated t_{obs} and p values for the differences of means.

For the overall sample of 20 subjects, analysis of CETI data shows significant improvement ($p < .05$) on fourteen of the sixteen items assessed and in the CETI Overall, and a trend towards significance on one additional item. Table 3 provides details, with initial and final mean scores, differences of means, standard deviations, and associated t_{obs}

and p values. For reference convenience, Appendix 1 lists the sixteen items rated on the CETI.

Tables 4 through 6 show the results of applying one-way ANOVAs – at intake, during participation, and at discharge – to investigate significant differences between the Gl:Gl vs. the Gl:Br groups. Most generally, the findings show that the two groups do not differ significantly – neither on most of the assessed items, nor at any of the assessment times. There are, however, a handful of items on which the two groups do differ significantly.

At intake: Significant differences all favor the Gl:Br group. At the impairment level (WAB), the the Gl:Br group scores significantly higher than the Gl:Gl group in AVC (diff. = 13.7, $F = 7.41$, $p = .014$), and in Naming (diff. = 7.5, $F = 5.92$, $p = .026$). And in functional communication, the Gl:Br group scores significantly higher on CETI Items #1 (“getting somebody’s attention”), #7 (“having a one-to-one conversation with you”), and #11 (“responding to or communicating anything without words”). Details are given in Table 4.

Improvements during participation: At the impairment level, the Gl:Br group improves significantly more than the Gl:Gl group in AVC. In functional communication, they Gl:Br group is favored on CETI Item #10 (“having a spontaneous conversation”). The Gl:Gl group, on the other hand, improves significantly more than the Gl:Br group on Item # 11 (“responding to or communicating anything without words”). See Table 5.

At discharge: Impairment items on which the two groups differ significantly are the very same ones as those at intake; however, the magnitudes of differences are now greater, and the spread in AVC is now particularly striking (diff. = 31.7, $F = 36.50$, $p << .0001$). At the functional level, but Gl:Br group scores significantly higher than the Gl:Gl group in just two items rather than three, but the skills involved are now more demanding – #7 (“having a one-to-one conversation with you”) and #11 (“having a spontaneous conversation”). See Table 6.

Discussion and Clinical Implications

Several points emerge from this study. First, for the sample of twenty subjects with chronic global aphasia, mean scores are shown to improve – following SGD use – only modestly and occasionally significantly at the impairment level, but with greater magnitudes and more frequent significance at the functional communication level. On most items assessed, there is no significant difference between the Gl:Gl and Gl:Br groups, but with a few important exceptions. For example, at intake, subjects in the Gl:Br group scored significantly higher in the mean on AVC than subjects in the Gl:Gl group. This suggests that AVC may have prognostic value in helping identify persons with chronic global aphasia who may yet be candidates for movement to Broca’s aphasia. For their part, people in the Gl:Gl group improved significantly more than the Gl:Br group after SGD use in responding to or communicating things – including yes and no – without words; this improvement can contribute importantly to better functional communication in global aphasia. Findings such as these should help us refine and further develop: (i) prognostic tools and procedures; (ii) identification of improvement profiles; and (iii) characterizations of clinical outcomes and their likelihoods.

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**Table 1: Demographic / Clinical Data Summary
for SGD Users in Chronic Global Aphasia (n = 20)**

<u>Characteristic</u>	<u>Mean (SD)</u>	<u>Range</u>	<u>No. (%)</u>
Gender			
male			12 (60.0)
female			8 (40.0)
Age (y)	67.2 (9.7)	44–85	20 (100)
Handedness			
right			9 (45.0)
unknown			11 (55.0)
Time postonset (y)	2.70 (2.35)	0.52–8.97	20 (100)
Etiology			
L-CVA			20 (100)
Intake Assessments			
WAB AQ	13.4 (5.2)	4.4–25.3	20 (100)
CETI Overall	30.8 (13.3)	7.6–61.9	20 (100)
Treatment			
frequency (sess/wk)	2.0 (0.5)	0.8– 3.0	20 (100)
duration (wks)	20.6 (7.8)	10.4–45.9	20 (100)
Assessments at Intake and Discharge			
impairment level (WAB)			20 (100)
functional level			20 (100)

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Table 2: WAB (Impairment Level) Changes in Chronic Global Aphasia following SGD Use

<u>Item</u>	<u>n</u>	<u>Initial Mean (SD)</u>	<u>Final Mean (SD)</u>	<u>Diff (SD)</u>	<u>t_{obs}</u>	<u>p</u>
Spontaneous speech	20	2.4 (1.5)	2.8 (2.0)	+ 0.4 (1.5)	+1.22	= .2371
Aud. verb. comprehen.	20	60.7 (12.8)	72.8 (19.4)	+12.1* (14.4)	+3.77	= .0013
Repetition	20	9.2 (14.4)	13.8 (14.3)	+ 4.6° (11.5)	+1.82	= .0852
Naming	20	4.2 (5.6)	7.5 (8.4)	+ 3.3* (4.6)	+3.07	= .0068
Aphasia Quotient (AQ)	20	13.4 (5.2)	17.0 (6.1)	+ 3.6* (3.9)	+4.14	= .0006

* $p < .05$; ° $p < .10$

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**Table 3: CETI (Functional Communication) Changes
in Chronic Global Aphasia Following SGD Use**

<u>CETI Item N°</u>	<u>n</u>	<u>Initial Mean (SD)</u>	<u>Final Mean (SD)</u>	<u>Diff (SD)</u>	<u>t_{obs}</u>	<u>p</u>
1	20	58.8 (31.4)	71.4 (23.2)	+12.6* (20.1)	+2.79	= .0117
2	19	30.0 (18.4)	42.6 (23.2)	+12.6* (10.2)	+5.37	< .0001
3	20	37.8 (22.2)	56.9 (20.5)	+19.1* (11.7)	+7.33	< .0001
4	20	42.1 (23.3)	59.1 (20.2)	+17.0* (10.3)	+7.38	< .0001
5	20	51.4 (21.8)	65.8 (19.3)	+14.4* (15.3)	+4.22	= .0005
6	20	37.2 (29.0)	48.0 (27.7)	+10.8* (15.7)	+3.07	= .0062
7	20	31.8 (22.5)	41.0 (25.3)	+ 9.2* (8.3)	+4.99	< .0001
8	20	18.2 (21.2)	31.1 (23.1)	+12.9° (28.2)	+2.04	= .0552
9	20	26.5 (18.4)	43.6 (20.7)	+17.1* (17.4)	+4.39	= .0003
10	20	22.1 (21.8)	33.5 (24.1)	+11.4* (13.8)	+3.71	= .0015
11	20	43.7 (30.4)	60.2 (24.7)	+16.5* (22.3)	+3.32	= .0036
12	20	22.2 (25.7)	31.8 (25.8)	+ 9.6* (12.2)	+3.51	= .0023
13	19	27.7 (26.6)	45.8 (31.8)	+18.1* (17.2)	+4.58	= .0002
14	19	15.1 (15.1)	18.6 (20.4)	+ 3.5 (11.3)	+1.36	= .1904
15	20	15.3 (20.1)	20.1 (20.3)	+ 4.8* (6.8)	+3.15	= .0052
16	20	11.1 (13.4)	15.9 (15.1)	+ 4.8* (5.7)	+3.74	= .0014
1–16 Overall	20	30.8 (13.3)	42.8 (14.4)	+12.0* (7.3)	+7.39	< .0001

* $p < .05$; ° $p < .10$

Table 4: Significant Initial Differences from One-Way ANOVAs Comparing

Global:Global (12) vs. Global:Broca's (8)

— SCORES AT INTAKE (*italics* = higher initial scores) —

<u>Items</u>	<u>Gl:Gl</u>	<u>Gl:Br</u>	<u>Diff</u>	<u>F-ratio</u>	<u>p</u>
WAB:					
Auditory verbal comprehension	55.2	<i>68.9</i>	13.7*	7.41	= .014
Naming	1.9	<i>7.5</i>	6.6*	5.92	= .026
CETI:					
1. Getting somebody's attention	46.3	<i>77.6</i>	31.3*	6.07	= .024
7. Having a one-to-one conversation with you	23.1	<i>44.9</i>	21.8*	5.57	= .030
11. Responding to or communicating anything (including yes or no) without words	30.5	<i>64.4</i>	32.9*	7.53	= .013

* p < .05

**Table 5: Significant Improvement Differences from One-Way ANOVAs Comparing
Global:Global (12) vs. Global:Broca's (8)**

— IMPROVEMENTS (*italics* = greater improvements) —

<u>Items</u>	<u>Gl:Gl</u>	<u>Gl:Br</u>	<u>Diff</u>	<u>F-ratio</u>	<u>p</u>
WAB:					
Auditory verbal comprehension	+ 4.9	+ 22.9	18.0*	11.70	= .003
CETI:					
10. Having a spontaneous conversation (<i>i.e.</i> , starting the conversation and/or changing the subject)	+ 5.4	+ 20.3	14.9*	7.66	= .013
11. Responding to or communicating anything (including yes or no) without words	+ 26.0	+ 2.2	23.8*	7.29	= .015

* p < .05

**Table 6: Significant Final Differences from One-Way ANOVAs Comparing
Global:Global (12) vs. Global:Broca's (8)**

— SCORES AT DISCHARGE (*italics* = higher final scores) —

<u>Items</u>	<u>Gl:Gl</u>	<u>Gl:Br</u>	<u>Diff</u>	<u>F-ratio</u>	<u>p</u>
WAB:					
Auditory verbal comprehension	60.1	<i>91.8</i>	31.7*	36.50	<< .0001
Naming	3.9	<i>12.8</i>	8.9*	7.08	= .016
CETI:					
7. Having a one-to-one conversation with you	31.2	<i>55.8</i>	24.6*	5.62	= .029
10. Having a spontaneous conversation (<i>i.e.</i> , starting the conversation and/or changing the subject)	+ 24.7	+ <i>46.6</i>	21.9*	4.77	= .042

* p < .05

Appendix 1: Items Rated on the *Communicative Effectiveness Index (CETI)*

1. Getting somebody's attention.
2. Getting involved in group conversations that are about him/her.
3. Giving yes and no answers appropriately.
4. Communicating his/her emotions.
5. Indicating that he/she understands what is being said to him/her.
6. Having coffee-time visits and conversations with friends and neighbors (around the bedside or at home).
7. Having a one-to-one conversation with you.
8. Saying the name of someone whose face is in front of him/her.
9. Communicating physical problems such as aches and pains.
10. Having a spontaneous conversation (*i.e.*, starting the conversation and/or changing the subject).
11. Responding to or communicating anything (including yes or no) without words.
12. Starting a conversation with people who are not close family.
13. Understanding writing.
14. Being part of a conversation when it is fast and there are a number of people involved.
15. Participating in a conversation with strangers.
16. Describing or discussing something in depth.

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