Efficacy of the PROMPT System of Therapy for the Treatment of Acquired Apraxia of Speech: A Follow-up Investigation

Paula A. Square
Graduate Department of Speech Pathology and
Neuropraxis Research Program, Toronto, Ontario

Deborah A. Chumpelik and Debra Morningstar
Bell Children's Centre, Toronto, Ontario

Scott Adams
Neuropraxis Research Program, Toronto, Ontario

Our purpose is to report the results of administration of the PROMPT System of Therapy (Chumpelik, 1984) to three patients with chronic apraxia of speech and aphasia. Last year at this Conference, we presented data which indicated that one patient with severe apraxia of speech and Broca's aphasia demonstrated accelerated learning curves for the production of minimally contrastive words (e.g. miss-mit) and functional phrases (e.g., "What time is it?"). Significantly improved intelligibility scores as measured by the AIDS (Assessment of Intelligibility of Dysarthric Speech, Yorkston and Beukelman, 1981) also were demonstrated. Decreased performances on all measures occurred subsequent to the withdrawal of therapy. The purpose of the present study was to determine whether the application of PROMPTs enhanced accuracy of motor speech production on various types of target stimuli.

The PROMPT System. The PROMPT System or "Prompts for Restructuring Oral Muscular Phonetic Targets" (Chumpelik, 1984), is a dynamic tactile and kinesthetic-based articulatory-prosodic treatment strategy for the enhancement of motor speech production. Although based upon principles of motokinesthetic therapy (Stichfield and Hawk-Young, 1938), PROMPTs affords more than place of production, voicing, oral-nasal and transitional cues. It provides patients with multiple simultaneous cues concerning the production of each segment. These multiple cues include place of production, voicing, orality-nasality, degree of jaw opening, manner of production, phoneme duration, and tense-lax muscular contraction cues. As well, the temporal delivery of PROMPTs is thought to enhance coarticulation and transitionalization as well as establishing rate control. PROMPT therapy previously has been demonstrated to be efficacious for the treatment of developmental apraxia of speech (Chumpelik and Sherman, forthcoming) and in the treatment of one chronic Broca's aphasic individual (Square, Chumpelik and Adams, 1985).

METHOD

Subjects. The subjects of the current investigation were three patients who demonstrated at least 9 of the 14 symptoms (Dabul, 1979) of apraxia of speech as derived from administration of the Apraxia of Speech Battery for Adults (Dabul, 1979) and the Mayo Clinic Screening Battery for Apraxia of Speech. Their apractic symptoms are summarized in Table 1. All subjects were classified as Broca's aphasic patients on the Western Aphasia Battery (Kertesz, 1982). Each was at least one year post onset, severely limited with regard to functional verbal expression, and discharged from formal speech and language therapy because of lack of progress.

Table 1. Characteristics of apraxia of speech of speech demonstrated by each patient.

Speech Characteristic	Patient PW	RJ	SS
Phonemic Anticipatory Errors			
Phonemic Perseverative Errors	X		X
Phonemic Transposition Errors			
Phonemic Voicing Errors	X	X	X
Phonemic Vowel Errors	X	X	X
Visible/Audible Searching	X	X	X
Numerous/Varied Off-Target	X	X	X
Errors Highly Inconsistent	X	X	X
Errors Increase with Length	X	X	X
Fewer Errors in Automatic Speech	X	X	X
Marked Difficulty Initiating		X	X
Intrusive Schwas, CCs		X	
Abnormal Prosody			
Awareness of Errors/Inability to Correct	X	X	X

Procedures. Performances of each subject were baselined over three consecutive days on production of 24 pairs of minimally contrastive phonemes given three times (total of 9 productions for each pair and 222 total productions), 10 bisyllabic words given 10 times each (total of 90 productions of each word) and 9 functional phrases (total of 90 productions of each phrase). Production of all stimuli were scored as correct or incorrect by the two clinicians. A third investigator who had not observed the patients' performances selected the stimuli for the investigation based upon the scored data. For each patient, four pairs of minimally contrasting phonemes were selected which had never been produced correctly. Two pairs were randomly selected for training using PROMPTs and two pairs acted as controls for probing imitation. For two subjects, four polysyllabic words were randomly selected--two for training using PROMPTs and two for probing. For the third subject, six polysyllabic words were selected--three for training and three for probing. For two subjects, functional phrases were trained. For one subject, two phrases were trained and two were probed. For the other subject, one phrase was trained and a second was not.

A scoring system of either totally correct or incorrect was applied. For phrases only, each word produced correctly received one point. Point-to-point interrater reliability using the correct-incorrect system was found to range from 86 to 95%. Mean reliability was 91%. Intrarater reliability using the latter scoring system was previously found to be .90 (Chumpelik and Sherman, forthcoming).

The PROMPT training procedure was as follows. First, the patient was presented with an auditory model of a minimal pair, word or functional phrase. No prompts were given. The patient attempted to repeat the target according to a model. If the response was correct, the next trial was

presented for a total of 20 (20 tokens presented). If however, the response was incorrect, the clinician prompted as follows: the subject was instructed not to respond as the clinician "mapped in" the correct motor pattern for the sequence of phonemes to be produced using the PROMPT System. The clinician then instructed the subject to attempt target phoneme, word or phrase as the clinician simultaneously PROMPTed the motor pattern again. The response was scored preceded by a "P" for "Prompt." The next token in each train of 20 was then presented auditorally for imitation and the same procedure was followed based upon the subject's ability to imitate the token.

RESULTS

Minimal Pairs. The percent correct productions for the minimal phoneme pairs for each subject are summarized in Table 2. Subject PW demonstrated accelerated learning curves for the phoneme contrasts which were trained using PROMPTs. Eighty percent accuracy of production for d/z was achieved by session 3 and maintained throughout the experimental period (i.e., up to and including session 12). For tʃ/ʃ, 90% accuracy of production was achieved by session 9 and maintained. Accuracy of production of the untrained pairs, f/v and t/k remained at 0%.

TABLE 2. Percent of trained and untrained phoneme contrasts accurately produced by each subject.

	SUBJECT											
	1 P.W.				2 R.J.				3 S.S.			
	Trained		Untrained		Trained		Untrained		Trained		Untrained	
Session	d/z	tʃ/ʃ	f/v	t/k	t/k	f/v	tʃ/ʃ	d/z	t/n	v/f	d/z	tʃ/ʃ
1	75	5	0	0	45	0	0	0	75	55	0	0
2	35	20	0	0	30	65	5	0	80	65	0	0
3	80	65	0	0	75	15	15	0	85	85	5	0
4	100	65	0	0	90	65	10	0	90	85	40	0
5	100	70	0	0	85	75	0	0	90	80	40	0
6	100	75	0	0	85	80	5	0	90	90	65	0
7	100	80	0	0	100	80	0	50	100	95	40	0
8	100	50	0	0	100	80	5	5	95	90	60	15
9	85	95	0	0	95	85	0	5	95	100	80	0
10	100	95	0	0	90	90	0	0	100	90	85	0
11	95	95	0	0	--	--	--	--	100	95	70	5
12	100	95	0	0	--	--	--	--	100	100	90	0

Subject RJ achieved 90% accuracy on the trained pair t/k by session 4 and maintained performances above 85% throughout the investigation (i.e., up to and including session 10). For the second trained pair, f/v, 80% accuracy of production by session 6 was attained and maintained.

For the untrained pairs, tʃ/ʃ and d/z, accuracy of production did not exceed 15% for the former and 50% for the latter. In the case of d/z, accuracy of production remained at 0% through session 6, sporadically reached 50% in session 7 and then diminished to 5 and 0% for the remainder of the experimental period.

Subject SS achieved 80% accuracy of production of the trained pair t/r by session 2 and 85% accuracy of the trained pair v/f by session 3. These performances were maintained and improved upon throughout the investigation, up to and including session 12. For the untrained pair, t/ʃ, daily performances hovered around 0% with the exception of session 8, in which 15% accuracy was achieved. For the second untrained pair, d/z, a slowly accelerated and variable learning curve was demonstrated. SS finally attained 80% accuracy of production by session 9, 85% for session 10, 70% for session 11 and 90% for session 12. This learning was thought to occur because the phonetic features of alveolar place of production and voicing contrasts were taught in the trained (prompted) pairs, t/n and v/f, respectively.

Polysyllabic Word Production. The percent correct production data for the polysyllabic words for each subject are summarized in Table 3. Subject PW attained 80% accuracy of production for the trained word "cabinet," and 95% accuracy of production for the trained word "sensation" by session 5. Level of accuracy of production was maintained above criterion level of 80% throughout the remainder of the experimental period with one exception. During session 8, accuracy of production of "cabinet" dropped to 60%. The untrained items, "tobacco" and "father," were produced with 0% accuracy over all twelve sessions.

TABLE 3. Percent of trained and untrained polysyllabic words accurately produced by each subject.

	SUBJECT													
	1 P.W.				2 R.J.				3 S.S.					
	Trained		Untrained		Trained		Untrained		Trained			Untrained		
Session	cabinet	sensation	tobacco	father	tobacco	scissor	canteloupe	father	decorate	chiffon	fanciful	canteloupe	seafood	sensatio
1	15	10	0	0	0	0	0	0	0	10	0	0	0	0
2	40	0	0	0	5	0	0	0	15	65	45	0	0	5
3	50	40	0	0	15	25	0	0	30	85	55	0	0	0
4	70	75	0	0	70	55	0	0	45	85	60	0	0	0
5	80	95	0	0	85	85	0	0	95	85	95	0	0	0
6	85	80	0	0	95	85	0	0	85	90	80	0	0	5
7	100	98	0	0	95	85	0	15	95	95	85	0	0	0
8	60	100	0	0	100	100	0	10	95	100	85	0	0	20
9	88	100	0	0	95	100	0	25	90	90	75	0	0	10
10	95	100	0	0	95	95	0	25	100	80	85	0	0	5
11	100	100	0	0	--	--	--	--	95	80	100	0	0	25
12	95	100	0	0	--	--	--	--	85	75	90	0	0	20

Subject RJ attained 85% accuracy of production of the two trained polysyllabic words "tobacco" and "scissor" by session 5. This level of accuracy of production was maintained and improved upon throughout the entire experimental period. For the untrained word "canteloupe" level of accuracy of production did not vary from 0% throughout the experimental period. For the untrained word "father" 0% accuracy of production was maintained through session 6. Minimal improvement was noted during session 7 in which 15% accuracy of production was achieved. This dropped to 10% during session 8 and improved to 25% in session 9 and maintained at this level for session 10.

Subject SS was trained on three and baseline was measured on three polysyllabic words. The trained words included "decorate," "chiffon," and "fanciful." By session 5, 95% accuracy of production was achieved for the words "decorate" and "fanciful." Accuracy of production was maintained at or above the criterion level of 80% for each for the remaining sessions of the experimental period. For the third trained word, "chiffon," 85% accuracy of production was maintained for the remainder of the experimental period, with the exception of session 12, in which production decreased to 75% accuracy.

Functional Phrases. Only for subjects PW and RJ were functional phrases trained and probed. Subject SS, who was six years post onset, attained baseline scores which hovered between 15% and 60% accuracy for phrase production. She appeared to have learned the strategy of syllable-by-syllable production in order to attain correct production of phrases. Since each word was scored in a phrase and a mean percent correct was derived for each, correct production of just one word in a four word phrase resulted in a score of 25% accuracy. Since subject SS often attained this level of success due apparently to compensatory strategies, she was not trained on phrases.

The accuracy of production data for subject PW and subject RJ on phrases is summarized in Table 4. For subject PW, on the trained (prompted) phrase, "Help me.", 90% accuracy of production was achieved by session 2 and improved upon until the attainment of 100% accuracy during session 4. This level of accuracy of production was maintained throughout the remainder of the experimental period. For the trained phrase, "How are you?" 95% accuracy of production was attained by session 3 and maintained above the 92% level for the remainder of the experimental period. PW's accuracy of production of the untrained phrase, "Stop it." hovered around 0% with a sporadic attainment of 43% accuracy during session 5. For the untrained phrase, "Give it to me." accuracy of production hovered around 25% from session 4 to the termination of the experimental period (session 12).

TABLE 4. Percent of trained and untrained phrases accurately produced by each subject.

	SUBJECT					
	1 P.W.				2 R.J.	
	Trained		Untrained		Trained	Untrained
Session	Help me.	How are you?	Stop it.	Give it to me.	What do you want?	Stop it.
1	78	08	0	18	04	01
2	90	68	0	15	46	08
3	95	95	10	18	66	0
4	100	95	0	25	86	10
5	100	100	43	28	92	25
6	100	92	5	30	90	25
7	100	100	25	25	90	15
8	100	100	20	25	97	05
9	100	100	0	25	98	03
10	100	100	10	26	98	10
11	100	100	0	25	--	--
12	100	100	15	25	--	--

Subject RJ was trained on one phrase and probed on another. The longer phrase was purposefully selected as the trained phrase since it is known that aphasic individuals with apraxia have more difficulty producing longer phrases. By session 4, the trained phrase, "What do you want?" was produced with 86% accuracy. This level of accuracy was improved upon throughout the remainder of the experimental period. The untrained phrase, "Stop it." was never produced with an accuracy which exceeded 25%. In fact, accuracy of production hovered between 0 and 15% during the experimental period.

DISCUSSION

Administration of PROMPT therapy was found to be highly efficacious for all three subjects involved in this study as well as for the subject presented last year at this conference (Square et al., 1985). For subject PW, little or no improvement of phoneme contrasts and polysyllabic word stimuli occurred for untrained items. Some minimal yet variable improvement was demonstrated for several words in untrained phrases. For the other two chronic subjects of this study, PROMPT therapy resulted in rapidly accelerated and stable performance curves for all trained items.

Future research regarding PROMPT therapy will address several issues. These will include the application of alternating treatment designs in which the effects of repetition, rhythmic timing (buccal tapping), phonetic placement and PROMPTs will be investigated as applied to the learning of functional phrases in chronic apractic-aphasic patients whose verbal output is limited. Such studies will be undertaken in order to determine what aspect(s) of PROMPT treatment account for its effectiveness. That is, is it the rhythmic delivery, cues for spatial targeting, or the simultaneous delivery of these subcomponents which contribute to the effectiveness of PROMPTs? Also, the rate of learning afforded by repetition versus PROMPT will be studied. Future studies also will use environmental probes in order to determine whether the phrases acquired in PROMPT treatment generalize to and are used functionally in the daily lives of our patients.

REFERENCES

Chumpelik, D. The PROMPT System of Therapy. Theoretical framework and applications for developmental apraxia of speech. Seminars in Speech and Language, 5(2), 139-156, 1984.

Chumpelik, D. and Sherman, J. The efficacy of the PROMPT System in the treatment of developmental apraxia (forthcoming).

Dabul, B. Apraxia Battery for Adults. Tigard, Oregon: C.C. Publications, 1979.

Kertesz, A. The Western Aphasia Battery. New York: Grune and Stratton, 1982.

Square, P.A., Chumpelik, D. and Adams, S. Efficacy of the PROMPT System of Therapy for the treatment of acquired apraxia of speech, Abstract. In R.H. Brookshire (Ed.), Clinical Aphasiology: Conference Proceedings, 1985. Minneapolis, MN: BRK Publishers, 1985.

Stichfield, S. and Younge, E. Children with Delayed and Defective Speech: Moto-Kinesthetic Factors and Their Training. Stanford, California: Stanford University Press, 1938.

Yorkston, K. and Buekelman, D. Assessment of Intelligibility of Dysarthric Speech. Tigard, Oregon: C.C. Publications, 1981.