

Critical Review:
Is PROMPT an effective treatment method for adults with acquired apraxia of speech and coexisting aphasia?

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This critical review examines the evidence from studies on the effectiveness of PROMPT therapy in the treatment of individuals with acquired apraxia of speech and coexisting aphasia. Four studies that met search criteria were obtained, all of which used single-subject multiple-baseline designs. This evidence-based literature review suggests that PROMPT therapy may be an effective treatment for patients with apraxia of speech and a concomitant aphasia, however more research is required to gain confidence in such a recommendation.

Introduction

In 1984, Deborah Chumpelik (Hayden) first applied the Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT) system to treat Developmental Apraxia of Speech (DAS) (Chumpelik, 1984). The Motor Speech Treatment Hierarchy was also developed for PROMPT treatment and is comprised of seven interdependent stages of intervention (Hayden & Square 1994). The system has since been adapted to treat adults with motor speech disorders (Square-Storer & Hayden, 1989).

The focus of PROMPT treatment is to program aspects of motor control by providing a target position for articulators through tactile and kinesthetic prompts in order to aid production of phonemes or sequences of phonemes (Chumpelik, 1984). These prompts serve to provide sensory input to the individual's face and neck, supplying information about the place of contact, degree of closure, manner and tension of articulation, as well as voicing, stress, timing, and coarticulation information. The system was designed to be flexible and to work from a phoneme level up to a conversational level.

Adult aphasia is an acquired impairment in the production, comprehension, or underlying cognitive processes of language, caused by damage to the brain (Chapey, 2008). The most common cause of aphasia is cerebrovascular accident (CVA) or stroke. Aphasia does not represent a loss of language, but an impairment in the ability to access language. Apraxia of speech (AOS) is an impairment in motor planning in the absence of an impairment in muscular control (Chapey, 2008). It is characterized by difficulty positioning articulators and sequencing speech movements. AOS often co-occurs with aphasia. PROMPT therapy has been used by clinicians to treat

patients with AOS and aphasia, but few studies have investigated the efficacy of this treatment.

Objectives

The primary objective of this review is to critically evaluate the evidence presented in research studies that examined the efficacy of PROMPT treatment for participants with acquired apraxia of speech and aphasia. The secondary purpose is to provide evidence-based recommendations for the clinical implementation of PROMPT therapy by clinicians treating individuals from this particular population.

Methods

Search Strategy

The studies reviewed were accessed using database searches, including PubMed, CINAHL, Scopus, ComDisDome, and EMBASE. The following key terms were searched:

[[PROMPT] OR [PROMPTs for Restructuring Oral Muscular Phonetic Targets] OR [PROMPT therapy] OR [PROMPT treatment] OR [PROMPT system]] AND [[apraxia of speech] OR [acquired apraxia of speech] OR [apraxia]]

The official PROMPT website (<http://www.promptinstitute.com/>) was also examined because it provided many citations and full-text articles.

Selection Criteria

Only articles written in English were selected for review. Participants of studies were required to be adults with acquired apraxia of speech and aphasia.

Data Collection

The search yielded four articles that were included in this review. All of the studies used single-subject,

multiple-baseline designs. The published conference proceedings for two of the studies (Square, Chumpelik & Adams, 1985; Square, Chumpelik, Morningstar & Adams, 1986) were located, because the full articles were not obtainable.

Results

Each of the studies reviewed suggested that PROMPT therapy is an effective treatment approach for individuals with aphasia and AOS. Square et al. (1985) used a single-subject, multiple-baseline design to study the effectiveness of PROMPT therapy on one participant with severe, chronic AOS and moderate Broca's aphasia. The authors of this study presented level 1 evidence. The authors compared PROMPT treatment with integral stimulation treatment simultaneously. Over the course of 21 treatment sessions, the authors collected multiple-baseline data on the participant's production of eight phrases and 13 minimally-contrasting word pairs. For the first three days, all stimuli were probed 30 times each using repetition. In order to measure improvement, all except the PROMPT-trained phrases were probed 30 times each for every subsequent day using the comparison treatment, repetition with integral stimulation.

The authors reported that the participant's accuracy of all segment productions on PROMPT-trained phrases improved to 90-100% within approximately four training sessions, while the phrases trained with integral stimulation showed no improvement. Similar results were found with the minimally-contrasting word pairs. The authors did not report baseline data by which improvements could be measured. The participant's intelligibility scores on the Assessment of Intelligibility of Dysarthric Speech (AIDS) (Yorkston & Beukelman, 1981) improved from 13% to 27% during intense training, but fell to 18% over five months of maintenance therapy.

The version of this study that was obtained is a very brief publication from the Clinical Aphasiology Conference Proceedings. Consequently, it was not possible to complete a thorough critical analysis of this research study and results must be interpreted with caution. In this brief article, the participant is not described sufficiently to allow for comparison with other studies or patient populations. Only a brief description of the study procedure is provided and the authors do not describe how stimuli were selected. A study's ability to be replicated by other researchers through the provision of specific details of procedures will enhance external validity (Dollaghan, 2007). It would be difficult for another researcher to replicate

this study based on the information provided in the article.

A sufficient amount and stability of baseline data increases confidence in a study's level of evidence (Harris, Heriza, Hickman & Logan, 2008). Square et al. (1985) do not report a sufficient amount of baseline data points or a stable baseline phase. Measurements were obtained by probing the comparison treatment during the experimental phase and by comparing pre and post-treatment intelligibility scores on the AIDS to measure maintenance. The evidence presented in this study could not be properly critiqued due to the brief nature of the article. However, based on the information available, the study provided evidence that may be considered suggestive, but results should be interpreted with caution.

Square et al. (1986) investigated the effectiveness of PROMPT therapy in enhancing the accuracy of motor speech production on a range of target stimuli for three participants. All participants were described as having acquired AOS, Broca's aphasia, severely limited functional verbal expression, and were more than one year post-onset of stroke. This article was also part of the Clinical Aphasiology Conference Proceedings and was a fairly brief version of the study, again limiting a thorough critique. The study does not provide an adequate amount of detail on procedures to enable easy replication. However, Square-Storer and Hayden (1989) provided some additional details about the study.

The authors presented level 1 evidence through a single-subject, multiple-baseline study design. They collected baseline data for minimally contrasting phonemes, bisyllabic words, and functional phrases over three consecutive days; sufficient baseline data and stability were not reported. The number of stimuli used for each participant was quite limited, ranging from one to four items per participant per category. It was unclear how these stimuli were selected for participants or whether they were chosen in conjunction with the participant and/or his or her family. Mean point-to-point intrarater reliability was strong (91.09%) for scoring stimuli using two systems: a graded system (for phrases only) and a correct-incorrect system. However, it was unclear whether the reliability of measurements was assessed before and during each phase of the study, which could serve to increase confidence in the measurement results (Harris et al., 2008).

The authors reported improved accuracy of production on all trained items for each of the three participants, with minimal to no improvement on untrained items. Participant 1 achieved 100% and 95% accuracy on the

two trained phonemes by the end of the experimental period with no improvement on the untrained phonemes. Participants 2 and 3 experienced similar results for the trained phonemes, but with up to 50% and 90% improvement respectively on untrained items. A similar pattern of results was found at the polysyllabic word level; participant 1 had up to 100% accuracy for trained items and 0% for untrained items, while participants 2 and 3 reached up to 100% accuracy on trained words and up to 25% accuracy on untrained words. Participant 1 reached 100% accuracy on trained phrases and up to 43% on untrained phrases and participant 2 achieved up to 98% on the trained phrase and as high as 25% on an untrained phrase. Improvement of untrained stimuli suggested that repetition of stimuli alone might have aided performance. Generalization of treatment effects to the daily lives of the patients was not investigated. This study's evidence is suggestive for the improvement of speech motor production accuracy in patients with aphasia and AOS through PROMPT treatment.

Variables other than those the researchers intended to study (i.e., miscellaneous nuisance variables) may influence results of a study and lead to inaccurate conclusions (Dollaghan, 2007). Miscellaneous nuisance variables may also compromise the internal validity of a study. Square et al. (1985, 1986) administered PROMPT therapy simultaneously with integral stimulation, which could have contributed to the participants' improvement and would be considered a nuisance variable.

Freed, Marshall and Frazier (1997) presented level 1 evidence with a modified single-subject, multiple-baseline design to examine the effectiveness of PROMPT therapy in improving the core vocabulary of a patient with aphasia and acquired AOS. The authors provided a thorough description of methods, including a detailed description of stimuli selection, enabling other researchers to replicate the study easily. The stimuli were 30 personally relevant functional words and phrases, chosen by the participant and his family, divided into six treatment sets of five items each. In order to avoid perseveration errors, stimuli were grouped according to the participant's preference, which eliminated randomization of the order of presentation and may have biased results.

Pre-treatment baseline data were collected using colour drawings or verbal questions presented by the clinician to elicit target words or phrases from the participant. Baseline probes were only administered three additional times before each set entered the treatment phase, and all were conducted in one 50-minute session. The authors used less than the typical amount of baseline

probing in order to avoid over probing target words, which compromised the integrity of the baseline phase and the multiple-baseline design and did not control for daily variation in production accuracy that is typical in this patient population.

Treatment procedures followed that of Square et al. (1986). Fifty-minute treatment sessions were conducted twice weekly until the participant achieved 80% accuracy, and was subsequently transitioned to the maintenance phase, which required the participant to repeat stimuli daily and produce stimuli in natural contexts. Probes were conducted once weekly to determine the participant's accuracy without cueing, in order to measure improvement in trained items. The 80% treatment criterion was met for all treatment sets, and the mean score of probes in the maintenance phase was 78.2%. Although treatment effects did not appear to generalize to untreated targets, the participant's family reported that he was able to use ten to twelve untrained words in appropriate contexts. This study provides suggestive evidence for the effectiveness of PROMPT therapy for patients with AOS and aphasia.

Bose, Square, Schlosser and van Lieshout (2001) presented level 1 evidence using a single-subject, multiple-baseline design to examine the effectiveness of PROMPT therapy in a patient with Broca's aphasia and acquired AOS. The primary purpose of the study was to examine the effectiveness of PROMPT therapy in improving the precision and automaticity of speech movements in three different sentence types: imperatives, active declaratives, and interrogatives. The secondary purpose was to examine changes in linguistic correctness of utterances apart from motor performance, secondary to supporting motor speech production in treatment.

The authors provided a thorough description of study methods and procedures, including a definition of the dependent measure. Consequently, other researchers could replicate this study easily. The stimuli were 30 personally relevant functional phrases, which were grouped into the three sentence types. Half of the phrases were randomly assigned to the training group and half were assigned as probes for generalization, which strengthened internal validity. Interobserver agreement checks were completed to measure speech motor performance for 30% of probes across each phase of the study. Mean interobserver agreement was 86% for baseline, 80% for daily, and 82% for maintenance probes. The authors reported a stable and low baseline for all sentence types.

Reported results of the treatment phase showed an increase in the accuracy of speech production for

trained and untrained imperatives (mean of 42% for trained and 53% for untrained) and active declaratives (mean of 45% for trained and 50% for untrained), but not for interrogatives (mean of 24% for both trained and untrained). This same pattern was reflected in the maintenance phase and in the grammatical correctness of utterances. Overall, an improvement was found for the more simple sentence types.

Single-subject designs do not provide convincing evidence when the participant's improvement may have occurred without any treatment, as would be expected in patients post-stroke (Dollaghan, 2007). These types of studies can be strengthened by the use of a multiple-baseline design, which treats one target while the other remains in baseline, and, therefore, any improvement in the treated target and not the untreated target can be attributed to the treatment and not just spontaneous recovery. The participant of the Bose et al. (2001) study was only 13 months post-onset of stroke, a time in which spontaneous recovery may continue to occur. Bose et al. (2001) provide suggestive evidence for the efficacy of PROMPT treatment for patients with AOS and aphasia. Statistical analysis of data and calculation of effect size were not conducted in any of the papers reviewed. Therefore, the authors of the studies could not fully objectively evaluate effects of treatment.

Discussion

Square et al. (1985) was a very brief article and the authors' use of a simultaneous treatment design rendered it difficult to attribute the patient's improvement solely to PROMPT therapy. The authors explained that although the simultaneous treatments weakened their design, it was preferable to using nonequatable linguistic stimuli with an alternating treatment design. Furthermore, the authors suggested that the stimuli in the integral stimulation group did not improve until PROMPTs were delivered, discounting the facilitating effects of integral stimulation.

Square et al. (1986) used a very limited number of targets for their participants; improvement in this limited number of stimuli did not represent a functional gain. Although Freed et al. (1997) did not use sufficient baseline data and randomization was eliminated, the participant was reported to have attained a 30-word functional vocabulary. The study by Bose et al. (2001) found an increase in functional vocabulary in two out of three sentence types, suggesting some interaction between linguistic complexity and motor processes. None of the studies reviewed included statistical analyses, which, if included, may have served to increase confidence in the results. Although further research is clearly required in this area, these studies

provide suggestive evidence for the efficacy of PROMPT therapy with adults with AOS and coexisting aphasia. Accordingly, results must be interpreted with caution due to methodological issues and compromises to both internal and external validity.

Internal validity measures the accuracy to which research evidence reflects the actual patients, procedures, and settings observed (Dollaghan, 2007). One of the factors that may impact internal validity is any subjective bias held by the author of the study. Two of the four studies reviewed, Square et al. (1985) and Square et al. (1986), were co-authored by the founder of PROMPT therapy, Deborah Chumpelik. Humans have a preference for information that supports pre-existing beliefs and a natural tendency to ignore information that may contradict their beliefs (Dollaghan, 2007). The fact that the founder of PROMPT treatment herself conducted half of the research studies on this topic presents a threat to the internal validity of these studies.

External validity allows a clinician to infer that the results of a research study can be generalized to participants and contexts outside of the study (Dollaghan, 2007). External validity is affected by the representativeness of participants of their population. All four studies reviewed used small sample sizes of one to three participants, which limited the potential of results to generalize to other patients. According to Harris et al. (2008), a study's evidence is strengthened when the effects of intervention are replicated across three or more participants; only the study by Square et al. (1986) met these requirements. Furthermore, with the population under investigation being extremely variable in terms of lesion site, severity, and presentation of symptoms, as well as every individual's unique personality, learning style, and course of recovery, it would be difficult to infer that PROMPT treatment would be effective for all patients with aphasia and AOS, especially when results were based on such a small sample size.

Conclusion

Based on this literature review, a recommendation for the use of PROMPT therapy to treat adults with apraxia of speech and aphasia is made with caution. Improvements in future research may serve to strengthen this recommendation. Research should attempt to use larger sample sizes and participants with varying degrees of severity and lesion sites in order to improve external validity. The effects of PROMPT therapy in patients with mild deficits and different levels of motivation and reactions to PROMPT cues should be investigated. The interaction between motor

planning variables and linguistic variables should also be examined in order to determine the best form of rehabilitation. Studies should include replicable, controlled methodologies, and statistical analyses should be provided in order to increase confidence in the evidence.

Clinical Implications

Although the evidence in the studies reviewed contains methodological limitations, the results suggest that PROMPT may be an effective therapy for patients with AOS and coexisting aphasia. Clinicians must consider several factors when deciding whether or not to use PROMPT therapy with these patients and how to most effectively implement treatment:

- PROMPT certification is recommended for proper delivery of treatment and is quite expensive.
- The evidence provided in the studies reviewed is merely suggestive for the efficacy of PROMPT therapy.
- The evidence provided indicated that PROMPT therapy may be effective for patients with moderate to severe aphasia and AOS; effects on participants with mild impairments were not investigated.
- Every patient is unique and clinicians should be prepared to be flexible if the patient does not benefit from PROMPT therapy.
- Clinicians should consider the linguistic demands placed on the patient; simple sentence structures may aid performance.
- PROMPT therapy may provide an alternative when more traditional therapy is not found to be productive.

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