Critical Review:
The efficacy of speech-language pathology intervention for naming deficits in primary progressive aphasia (PPA)

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Background: Treatment for naming deficits has shown to be efficacious in stroke-induced aphasia, however, questions still remain about its effectiveness for individuals with primary progressive aphasia (PPA).
Aims: The primary purpose of this paper is to critically examine the current literature surrounding PPA and therapy for its naming deficits. Secondarily, the objective is to determine whether it is efficacious for speech-language pathologists (SLP's) to provide naming intervention for individuals with PPA.
Methods and procedures: Computerized databases were searched and selection criteria were employed.
Results: The effects of semantically-based interventions, interventions using MossTalk Words®, and two other types of interventions were explored. Results of all studies showed limited evidence for post-treatment gains in naming ability for individuals with various types of PPA.
Conclusions: Findings indicate that regardless of the intervention type chosen, SLP intervention for naming deficits in individuals with PPA can be considered efficacious.

Introduction

Primary progressive aphasia (PPA) is an acquired impairment of language with relative sparing of other aspects of cognition that results from degenerative neurological disease (Henry, Beeson, & Rapcsak, 2008). There are at least three variants of PPA: progressive nonfluent aphasia (PNFA), semantic dementia (SD), and logopaenic progressive aphasia (LPA) (Newhart et al., 2009). However, within the literature there is some confusion over whether or not SD is in fact a variant of PPA.

Whereas most individuals acquire aphasia as the result of a stroke, individuals with PPA experience neurodegenerative changes in the fronto-temporal lobes of the brain (Jokel, Cupit, Rochon, & Leonard, 2009). Clinicians working with individuals affected by PPA cannot depend on the same breadth of treatment literature as those working with patients with post-stroke aphasia. Clinicians are often at a loss as to what might be done with those with progressive aphasia (Jokel, Rochon, & Anderson, 2010). Also, to date no specific treatment approach is available for PPA in most clinical settings (Marcotte & Ansaldo, 2010). It has been suggested that one of the reasons for the lack of evidence on the treatment of such progressive disorders is the discouraging progression of language decline (Jokel et al., 2010).

Naming impairment, or anomia is seen as the most pervasive of the language deficits that are associated with aphasia. This is true for both the stroke- induced form of the disorder and the progressive form of the disorder. It is widely known that difficulties with naming are associated with difficulties in spoken language production (Henry et al., 2008). As naming is one of the most important deficits associated with PPA, it is important to determine whether or not it is effective for speech-language pathologists (SLP's) to provide intervention regarding this deficit in individuals with PPA.

Objectives

The primary objective of this paper is to critically examine the current literature surrounding PPA and traditional therapy for naming deficits. The secondary objective is to determine whether or not it is clinically efficacious for speech-language pathologists (SLP's) to provide intervention for the naming deficits associated with PPA.

Methods

Search Strategy

Computerized databases, including CINAHL, PubMed, EMBASE, and PsycInfo were searched using the following strategy:
(primary progressive aphasia) AND (therapy) AND (naming).

The search was limited to articles written in English.

Selection Criteria

Studies selected for inclusion in this critical review paper were required to investigate the effectiveness of any type of speech-language pathology naming intervention with individuals diagnosed with PPA. For the purposes of this paper SD was included as a variant of PPA.

Data Collection

Results of the above search and inclusion criteria revealed the following type of articles: single subject multiple baseline pre-posttest design (6), single subject time series design (1) and single subject 'n of 1' design (2). Bier et al. (2009), Henry et al. (2008), and Marcotte & Ansaldo (2010) performed semantically-based interventions. Jokel et al. (2009) and Jokel et al. (2010) performed interventions using MossTalk Words®. Graham, Patterson, Pratt, & Hodges (1999) included three different experiments with the same patient. Newhart et al. (2009) used a cueing hierarchy treatment approach.

Results

Single Subject Designs

Although single subject designs are not ideal for some types of research, they can be seen as appropriate designs for studying PPA. PPA is much more rare than post-stroke aphasia. For rare disorders single subject designs are often warranted, as it is difficult to recruit groups of individuals with a rare disorder. Also these designs allow one to examine change and variability within an individual while maintaining good experimental control (Jokel et al., 2009). However, it is important to note some of the disadvantages associated with single-subject designs including: limited generalization, the possibility that all outcomes may not be observed, and the fact that smaller effects may be more difficult to detect. Also, because of the nature of these designs, blinding is often not possible.

Semantically based interventions

Bier et al. (2009)

These authors studied the effects of formal semantic therapy and the spaced retrieval (SR) method on a subject (TBo) with SD. TBo's diagnosis was based on widely accepted neuroimaging and behavioural tests of the brain and language. TBo was exposed to an alternating treatment design including multiple baselines. Intervention consisted of an alteration between formal-semantic therapy with a SR method and a simple repeated practice method. Assessment and treatment procedures were appropriate and well described. Using visual inspection and appropriate non-parametric analyses, post-treatment results revealed a clear increase on trained items while untrained items remained at baseline. TBo obtained better results with SR than with simple repetition however the difference between the two methods was not statistically significant. No generalization effects were recorded between trained items and control items belonging to similar semantic categories.

Overall, this study provided some limited evidence of immediate post-treatment gains in naming ability, but no evidence for generalization. It is important to note that the treatment plan in this study is not considered intensive and therefore could be employed in many clinical settings.

Henry et al. (2008)

These authors studied the effects of semantic treatment for anomia in three patients, two with PPA (PA1 and PA2) and one with post-stroke aphasia (LH). All three individuals presented with anomic aphasia according to appropriate language and memory assessment tools. However, it should be noted that no neuroimaging data were provided. Treatment was intended to improve generative naming for selected semantic categories. Sufficient information to replicate a similar treatment design was given. Treatment outcomes were quantified using appropriate non-parametric analyses. PA1 had a strong, positive response to treatment indicated by large effect sizes for trained categories and a smaller effect size for maintenance at four months. However at four months post-treatment, performance for untreated items had declined. In contrast to PA1, PA2 showed a small but significant change in performance for trained categories but there was no maintenance over time.

Overall, this study showed limited evidence that some patients with PPA are able to improve their naming abilities immediately post-treatment, at least for trained categories. It is important to note that the treatment regimen for this study and the following semantically based intervention is considered intensive and therefore may be difficult to replicate in most clinical settings.

Marcotte & Ansaldo (2010)

These authors conducted a pre/post therapy event-related fMRI study to examine the impact of semantic feature analysis (SFA) therapy on neural substrates. Two participants with aphasia were included, one post-stroke (CM) and one with PPA (FC). Along with pre-therapy fMRI, appropriate language, naming, and memory assessments were given. Intervention

procedures were well described. The fMRI data were analyzed using conventional statistical parametric mapping analysis, considered appropriate for fMRI data. FC showed larger post-therapy activation maps compared with pre-therapy ones and more significantly activated semantic processing areas when naming trained items. The authors stated that FC's activation was consistent with the semantic nature of SFA and therefore likely to have been therapy induced.

Overall, this study provides some evidence of greater semantic activation in the brain during naming tasks post-treatment for an individual with PPA. This suggests that PPA does not necessarily preclude adaptive neural plasticity.

Interventions involving MossTalk Words®

MossTalk Words® is a computer-based therapy for individuals with receptive and expressive language disorders. The system comprises a large array of words with corresponding pictures and both spoken and written cues (Jokel et al., 2009).

Jokel et al. (2009)

These authors studied the treatment-specific effects of improvements using clinician-guided therapy with MossTalk Words® in two individuals diagnosed with NFPA (P1 and P2). Both patients were assessed appropriately using the Philadelphia Naming Test (PNT) and neural imaging reports. With the exception of age, both subjects were well matched on all measures administered prior to the study. Stimuli selection, procedures, and progress monitoring were well described, appropriate, and unbiased. Using visual inspection and appropriate non-parametric statistical analyses, data demonstrated a clear dramatic impact of treatment on naming performance for P1 and a more subdued impact for P2. Results showed gains immediately post-treatment and good maintenance at one but not at six months post-treatment for trained items.

Overall, this study showed some limited evidence of post-treatment gains in naming ability immediately and four months after treatment. The authors suggest that one possible benefit of providing treatment for individuals with PPA is the maintenance of residual skills. It should be noted that both studies using MossTalk Words included intensive treatment procedures that may be unrealistic in most clinical settings.

Jokel et al. (2010)

Encouraged by the positive results in the 2009 study, the authors wanted to re-train forgotten words by using errorless learning with MossTalk Words® as treatment for an individual with SD (CS). Appropriate assessment measures included: neuroimaging tests, several measures of semantic knowledge, appropriate language and memory assessments. Stimulus items were well chosen and treatment procedures were well defined. A questionnaire related to quality of life (QoL) was administered before and after treatment. It should be noted that this is the only paper reviewed that included a QoL measure. Appropriate statistics were employed including adjustments for multiple comparisons. Several appropriate and converging analyses revealed improvements for the trained but not untrained words. Improvements were maintained at one and three months post-treatment. CS's scores on the QoL measure increased from pre to post-treatment, however, the results were not significant.

Overall, this study showed limited evidence of post-treatment gains for naming of trained words. The authors stated that they believe treatment provided a semantic basis to rebuild information lost from CS's semantic store.

Other intervention types

Newhart et al. (2009)

These authors wished to identify differences in patterns of success and generalization in response to the same treatment in a patient with LPA and a patient with SD. Patients were chosen appropriately on the basis of history, neurological exam, imaging, and neurocognitive assessments. Appropriate language assessments were used for baseline data. Therapy consisted of a cueing hierarchy treatment that was well described. However, the treatment may be difficult to replicate in many clinical settings, as it is considered intensive. Patients had different schedules and were treated by different therapists with no manipulation checks to ensure consistency of therapy administration, thereby affecting experimental control greatly. Parametric tests were employed for data analysis although no information regarding the distribution of the data was reported. For the patient with LPA, mean post-treatment naming accuracy across all categories was significantly higher than mean pre-treatment accuracy, showing more improvement in trained than untrained categories. The patient with SD showed a non-significant decline in language over time. She showed less deterioration in naming untrained items in trained categories than untrained categories.

Due to the way therapy was carried out with the two patients involved and the way the data was analyzed, overall, this study only provided extremely limited evidence of post-treatment gains in naming accuracy for an individual with LPA for trained categories.

Graham, Patterson, Pratt, & Hodges (1999)

These authors chose to investigate the naming performance of an individual with SD (DM) by using three separate experiments. It should be noted that DM is considered an exceptional patient and therefore generalization of the results from this study to other patients may be limited. His extensive practice schedule included phonologic and semantic stimulation and his anomia impairment was not profound. DM's diagnosis was confirmed appropriately by imaging studies and a variety of appropriate neurocognitive tests. For the first experiment, the authors gave DM a battery of tests at four different occasions. DM's scores on the majority of the tests of word production increased over time however, no statistical tests were employed to determine the significance of these results. For the second experiment, authors gave DM a category fluency test using practiced and unpracticed categories. An appropriate statistical analysis was performed and results showed a significant difference between DM's performance on practiced vs. non-practiced categories. The third experiment involved formally testing DM's ability to produce examples in category fluency before and after rehearsal. Again using an appropriate statistical analysis, DM's performance on categories after practice was significantly higher than his performance before practice, therefore DM showed a significant effect of practice.

Due to the exceptionalities of the patient studied, overall this study showed very limited evidence that it is possible for a patient with SD to relearn words that were previously difficult to name.

Discussion

As mentioned previously, the results from these seven studies need to be interpreted with caution because of their single-subject designs. Also, the studies included patients with different variants of PPA, which made it difficult to make comparisons across studies. As well, many of the studies employed different baseline and outcome measures, another factor that made it difficult to draw comparisons between them.

Although all studies show limited evidence towards improvement in naming ability post-treatment for individuals with PPA, taken together, the evidence is striking. Regardless of the treatment for naming deficits chosen, all studies showed some improvement of naming ability in individuals with PPA. For example, in Newhart et al.'s (2009) study, it is thought that therapy may have facilitated access to the phonological lexicon for the patient with LPA and that therapy may have strengthened semantic representations of trained items in the individual with SD.

In terms of the semantically based therapies, studies using an intensive treatment approach (Henry et al., 2008; Marcotte & Ansaldo, 2010) and a study using a less intensive treatment approach (Bier et al., 2009) both showed improvements. Marcotte & Ansaldo (2010) showed that improvement was even seen when using simple repetition treatment. Therefore even in a clinical setting where an intensive treatment approach is not possible, improvement can still be seen for individuals with varying forms of PPA. Also Marcotte & Ansaldo (2010) noted by using fMRI, that therapy (at least SFA) appears to trigger compensatory brain plasticity mechanisms in PPA. Their evidence suggests that degenerative diseases such as PPA do not preclude brain plasticity.

Studies of patients being treated using MossTalk Words® suggest that computerized therapy can also be appropriate for individuals with PPA (Jokel et al., 2009; Jokel et al., 2010). It is considered likely that in the years to come computer-based treatment may become more popular. Therefore it is crucial that clinicians understand that individuals with PPA can also benefit from this type of treatment even without continuous practice.

Although Graham et al.'s (1999) study included an exceptional patient, the results showed that it is possible for a patient with SD to relearn familiar words that have become difficult to produce. Also, the patient was able to learn new vocabulary even if performance was constrained by practice. Although some of the patient's success can be attributed to his personal characteristics, this study showed that re-learning is possible in SD.

Clinical Implications

The results of this critical review indicate that it can be beneficial to perform intervention on patients with PPA. Taken collectively, the above studies indicate that speech-language pathology intervention for the treatment of naming difficulties in PPA can be effective and therefore, efficacious. All interventions reviewed in this article produced at least some form of improvement for patients with various varieties of PPA. While improvements with these individuals can be viewed as limited it is possible that therapy may help to maintain residual skills in these patients (Jokel et al., 2009).

Therefore, it is important that speech-language pathologists are aware that intervention can be beneficial for naming difficulties in PPA. Speech-language pathologists can and should initiate intervention with all patients with all varieties of PPA as some improvements, or at the very least maintenance of residual skills, can be seen.

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