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Traditional Treatment and Altered Auditory Feedback Lead to Intelligibility Benefits in a Subset of Speakers with Parkinson Disease

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Traditional treatment and altered auditory feedback lead to intelligibility benefits in a subset of speakers with Parkinson disease[1]

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What are the effects of traditional rate control treatments and altered auditory feedback (AAF) devices on the speaking rate and intelligibility of people with Parkinson disease (PD)?

METHODS

Design: The authors reported using an alternating treatment design, although the methodology involved aspects of an ABACA/ACABA design. Participants received each type of intervention once, separated by a 6-week no treatment period. Performance was measured before and after each treatment and also after 6 weeks and 6 months.

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Allocation: Individuals were quasi-randomly assigned to receive one treatment or the other first. They were alternately assigned as they entered the study.

Blinding: It is not reported whether the therapists providing the treatment were blind to the study's purpose. The individuals analyzing the acoustic data and judging intelligibility were blind to the treatment condition and assessment time.

Study duration: The baseline assessments, two 6-week treatments, and follow-up evaluations covered a 48-week period. Because participants did not all join the study at the same time, the overall investigation was completed in 18 months.

Setting: Assessments and intervention sessions took place in quiet conditions in the participants' homes.

Participants: Six men and 4 women with idiopathic PD took part in the study. Exclusion criteria included significant dementia or a history of deep brain stimulation or speech therapy for dysarthria symptoms within the prior year.

Intervention: Two interventions were given; each was provided in hour-long sessions once a week for 6 weeks. There was a 6 week period of no treatment between the two interventions. Traditional therapy (TT) focused on rate reduction, with most participants choosing pause insertion over stretching out articulation. Following a typical clinical hierarchy, the participants moved from short phrases to conversational speech to practice reducing their rate. Verbal feedback and audio recordings helped them develop self-monitoring skills. Altered auditory feedback (AAF) relied on delayed and/or frequency shifted feedback to achieve slower speech, with participants choosing one of two devices. During the initial sessions the participants tried different feedback types and settings to determine which would reduce rate most effectively with a minimal negative impact on

naturalness. Since the effect of the device on rate was immediate in most cases, no further attention was directed at slower speech. For both intervention types, additional treatment was directed when necessary at other aspects of speech, such as intonation.

Outcomes: Speech rate was measured as the number of syllables spoken per second in a reading passage. A second experimenter re-analyzed 10% of the data, which was significantly correlated (r = .444) with the original measures. The reading passage was judged for perceived intelligibility using direct magnitude estimation and the monologue was evaluated with a 9-point Likert scale. Agreement between raters for the monologue was high (intraclass correlation coefficient r =.89).

Attrition: All participants completed the study.

MAIN RESULTS

For the group, there were no statistically significant increases in intelligibility or decreases in speech rate following either type of treatment. No significant differences were found between the effects of the two treatment types. A comparison between AAF and no feedback conditions showed that rate decreased while the feedback device was active, but that intelligibility was not affected. Although no significant group effects were found regardless of treatment type, 4 of the 10 participants improved in intelligibility after the first treatment phase. These gains were maintained across the remaining assessments, including at the 6-month follow-up. Three participants showed increased intelligibility while the AAF device was in use during each of the assessments, but three speakers showed no improvement from either intervention.

AUTHOR'S CONCLUSIONS

A subset of individuals with PD may benefit from traditional therapy that targets reduced speaking rate. Speakers who do not experience improvements may not be generalizing therapy techniques to situations outside the clinic. AAF devices can lead to improvements in speaking rate and intelligibility in about one third of the participants, thus for some speakers this could be an effective treatment option. Improvements in speech with AAF could not be trained during therapy, and thus the benefits seem limited to those speakers who show an immediate, automatic response to the device. Habituation to the device can lead to decreased benefits in some speakers, but minor adjustments to the settings may restore AAF effectiveness. Some patients may find AAF unacceptable because the more effective binaural devices are conspicuous. The diminutive size of the controls can present problems for individuals with PD whose motor control is impaired.

Commentary

Because relatively little evidence has been published that compares the long-term effects of different dysarthria treatments, the authors undertook a study to document changes in speech rate and intelligibility in response to two types of intervention. Rate control is taught in many speech-language pathology training programs as a means to improve speech intelligibility, and thus it was a logical choice for the present study. Likewise, AAF has been shown to impact both normal and disordered speech, in most cases resulting in reduced rate. In theory, either approach should have a positive effect on speech, since individuals with neuromotor control deficits would have more time to reach their articulatory targets. However, as the authors of the present study noted, the

relationship between speaking rate and intelligibility is not simple (Van Nuffelen, De Bodt, Vanderwegen, Van de Heyning, & Wuyts, 2010).

Previous work (Tjaden & Wilding, 2004) has shown that reduced rate can increase the acoustic distinctiveness of vowels, although improvements in scaled intelligibility were not found. The speakers in the Tjaden and Wilding study were tested on a single occasion as they altered their speaking rate at the request of the experimenter, much like the simulated treatments reported by others (Dromey, 2000). In contrast, a particularly valuable contribution of the present study was that speakers were recorded before and after a course of intervention by a speech-language pathologist. This approach involves substantially more work, but also yields results that are more valid in evaluating the impact of the intervention. By assessing and treating the participants in their own homes, the researchers further strengthened the ecological validity of their work, since this setting is not atypical of service delivery in the United Kingdom.

In treating the participants' dysarthria in a clinically representative way, the authors may have introduced additional influences beyond the two main treatment effects of slower rate and AAF. For example, by allowing the speakers to select either pause insertion or syllable lengthening to achieve slower speech, or to select one of two AAF devices, the external validity increased (since typical patients would likely be given this option), but at the cost of adding the confounding variable of each participant's treatment preference to the main independent variable of rate adjustment versus AAF. Another area where there may have been a trade-off in increasing external validity while potentially reducing internal validity was where the authors noted that "where appropriate, other speech aspects in need of treatment, such as volume or intonational variation" (p. 429)

were also treated, and homework assignments were given that may have been completed more diligently by some participants than by others. Since the listeners judged perceived speech intelligibility, this overall rating could have been influenced by more than just rate reduction or AAF. However, it should be stressed that the therapy was more reflective of typical clinical practice as a result of this approach, which in the end is likely to be of greater value to the article's audience than the purity of the independent variable. On the other hand, without strong internal validity, the desired external validity may be compromised. The ABACA/ACABA design (Schlosser, 1999) of the present study allowed potential order effects to be minimized for the treatment groups as a whole. However, it did not allow this protection at the individual participant level in the same way as a true alternating treatment design would. An alternating treatments design involves the provision of two treatments that are alternated in rapid succession to allow changes accompanying each approach to be graphed and compared (Wong, 2010).

The take-home message of this paper is that while not all participants in a treatment group will show consistent and thus statistically significant changes in intelligibility as a result of therapy, individual speakers with PD show evidence of improvement from both traditional and AAF treatments. Inter-speaker variability is a clinical and research reality in neurogenic communication disorders. Clinicians would be well advised to undertake treatments that have been shown in the literature to positively affect functional communication, adapting these interventions where necessary to maximize individual benefits. Since both rate reduction and AAF can lead to improvements in intelligibility for some speakers, in addition to the well-documented effects of treatments like Lee Silverman Voice Treatment (Ramig, Fox, & Sapir, 2004),

clinicians should consider a variety of therapy options, tailored to the circumstances of the individual patient.

Declaration of interests. The commentary author has no conflicts of interests and is solely responsible for the content of this structured abstract.

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