

## **Critical Review:**

Does Lee Silverman Voice Treatment (LSVT) have a long-term effect on speech intensity in individuals with Parkinson's disease?

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This critical review examined literature on the long-term effects of the Lee Silverman Voice Treatment (LSVT) program on speech intensity among individuals with idiopathic Parkinson's disease (PD). Four longitudinal randomized control trials and one longitudinal study were included in this review. Overall, these studies provided suggestive evidence to support the use of LSVT for the long-term maintenance of increased speech intensity among individuals with PD. Recommendations for clinical practice and future research are discussed.

### ***Introduction***

Parkinson's disease (PD) is a progressive neurological disease that results from damage to the basal ganglia, a subcortical structure in the brain (Duffy, 2005). The loss of nerve cells and decreased levels of dopamine within the basal ganglia result in the presentation of the key motor and speech symptoms (Duffy, 2005). Speech and voice problems are experienced by approximately 75% of individuals with PD (Logemann, Fisher, Boshes, & Blonsky, 1978). One of the most common speech characteristics associated with Parkinson's disease is "hypophonia" or reduced speech intensity (Adams & Dykstra, 2009). Fox and Ramig (1997) attribute this deficit in speech intensity to a calibration error or an inconsistency between the actual intensity of speech production and the perceived amount of effort involved in speech production. Reduced speech intensity can be debilitating for individuals with PD, leading to frustration from communication partners, decreased communicative confidence, and social isolation (Adams & Dykstra, 2009; Burns, 2002; Duffy, 2005; Miller, Noble, Jones, Allcock, & Burn, 2008).

One of the predominant therapies used to treat reduced speech intensity in Parkinson's disease is Lee Silverman Voice Treatment (LSVT; Fox, Morrison, Ramig, & Sapir, 2002; Kwan & Whitehill, 2011). LSVT is a phonatory-respiration based therapy with its foundations grounded in motor learning theory, which emphasizes high intensity, repetition, and frequency of practice (Ramig, Countryman, O'Brien, Hoehn, & Thompson, 1996; Sapir et al., 2002; Spielman, Ramig, Halpern, & Gavin, 2007). The LSVT program was designed to continually remind clients to "think loud" by

monitoring speech loudness and using maximum effort when speaking (Ramig, Pawlas, & Countryman, 1995). The LSVT program consists of a total of 16 therapy sessions that are administered for 1-hour, 4 times a week over a period of 4-weeks (Ramig et al., 2001a). Therapy involves a combination of sustained 'ah' vowel phonations, up/down pitch glides, reading functional phrases, and speech production tasks like conversation (Ramig, Sapir, Fox, & Countryman, 2001b).

A great deal of information is known about the effectiveness of LSVT on hypophonia in PD immediately following therapy but little is known about the long-term effects of LSVT on speech intensity in PD (Herd et al., 2012; Yorkston, Hakel, Beukelman, & Fager, 2007). Since LSVT therapy is used extensively to treat speech and voice problems in PD, it is worthwhile investigating whether the treatment related increases in speech intensity can be maintained over the long-term.

### ***Objectives***

The primary objective of this paper is to critically evaluate existing literature regarding the long-term effectiveness of the Lee Silverman Voice Treatment program on speech intensity among individuals with Parkinson's disease. The secondary objective of this paper is to make suggestions regarding the clinical implications and to provide recommendations for future research.

### ***Methods***

#### Search Strategy

To find articles for this critical review, the PubMed, Medline-OVID, and Google Scholar computerized

databases were used. The following key words were used for the database search: [(LSVT) OR (Lee Silverman Voice Treatment) AND (speech intensity) OR (speech loudness) AND (long-term) OR (follow-up) AND (Parkinson's disease) OR (Parkinson's)]. In addition, the reference lists of key articles were manually searched for pertinent articles that met the inclusion criteria for this critical review.

#### Selection Criteria

The studies selected for inclusion in this critical review were required to investigate the long-term effectiveness (i.e., beyond post-treatment data collection) of the LSVT program among individuals with idiopathic PD using either objective measures of speech intensity or subjective measures of speech loudness. There were no limitations placed on the age of the participants, time since diagnosis, stage of Parkinson's disease, severity of the speech and/or voice problems, and the length of follow-up.

#### Data Collection

The literature search yielded 5 articles that met the selection criteria, including 4 longitudinal randomized control trials and 1 longitudinal study. Four of the studies assessed objective measures of speech intensity and one of the studies examined subjective measures of speech loudness. Long-term measures ranged from 6 months to 2 years post-treatment.

The level of evidence was rated for each study using the levels of evidence scale that was adapted from the Oxford Centre for Evidence-based Medicine (OCEBM, 2009).

### **Results**

#### Longitudinal Randomized Control Trials

A respiratory treatment program (RET) was used as the control group for 3 of the RCTs. RET entails increasing respiratory effort in order to increase loudness (Sapir et al., 2002).

Ramig et al. (1996) examined the long-term effects of LSVT (n=22) versus RET (n=13) on speech intensity among individuals with idiopathic PD up to 12 months follow-up. Acceptable MANOVAs revealed that only the LSVT group showed a significant increase and maintenance of this increased speech intensity at 6 months and 12 months follow-up for sustained vowel phonation and reading "The Rainbow Passage" but not for the conversational monologue task.

This level 1 study was successful at ensuring that both clinicians worked together and provided high levels of motivation when administering the LSVT and RET treatments. However, no measures of inter- or intra-rater reliability were reported. Not all participants completed the conversational monologue task, which may have resulted in an inability to detect a significant difference in speech intensity. In addition, the smallest overall gains in speech intensity were made for the conversational monologue task. This finding was discouraging considering that the monologue was the most representative of natural conversational speech of all the speech intensity measures. Therefore, the evidence from this study is deemed suggestive as there are methodological concerns within this research study.

Ramig et al. (2001a) investigated the long-term effects of LSVT (n=21) versus RET (n=12) on speech intensity among individuals with idiopathic PD up to 2 years post-treatment. Test-retest reliability for speech intensity was acceptable. An appropriate repeated measures ANOVA statistical analysis revealed a significant increase in speech intensity in the LSVT group from pre-treatment to 2 years follow-up for all speech tasks. The LSVT group demonstrated significantly higher speech intensity than the RET control group up to 2 years follow-up for sustained vowel phonation and "The Rainbow Passage" but not the conversational monologue.

This level 1 study was the first to investigate and demonstrate the efficacy of LSVT up to 2 years post-treatment. The researchers were cautious about avoiding potential biases. Therefore, the primary investigator was only responsible for data collection and was blinded to each participant's assigned treatment group. However, the results for conversational monologue were non-significant, which is disappointing because this task best represents normal conversational speech. The information gained from this study was important but there were concerns with the results, therefore, the evidence from this study was considered to be suggestive.

Ramig et al. (2001b) investigated the changes in speech intensity related to LSVT among individuals with PD up to 6 months follow-up. Participant groups consisted of neurologically normal age-matched controls (n=14), an LSVT PD treatment group (n=14) and a PD control group (n=15). An acceptable repeated measures ANOVA statistical analysis indicated that only the LSVT PD group demonstrated a significant increase in speech intensity (~6 dB SPL)

from pre-treatment to 6 months follow-up across all speech tasks (sustained vowel phonation, reading “The Rainbow Passage,” describing the “Cookie Theft Picture,” and conversational monologue).

This level 1 study demonstrated a strong research design with 3 treatment groups of similar size. The researchers included both a PD control group and a neurologically normal control group in an effort to rule out extraneous variables (Ramig et al., 2001b). A picture description speech task, which represents more naturalistic speech, was used in addition to the LSVT treatment protocol, and the LSVT PD group showed improvements on this measure. Multiple recordings were taken for each speech task; however, no test-retest reliability scores were reported. Overall, the evidence from this study was regarded as suggestive because there were some methodological concerns.

Sapir et al. (2002) investigated the long-term effects of the LSVT program (n=22) versus RET (n=13) on listeners’ perceptual judgments of speech loudness in individuals with PD up to 12 months follow-up. Three expert listeners and 3 naïve listeners made perceptual judgments for each participant’s recording of “The Rainbow Passage” and determined whether the pre-treatment or post-treatment recording sounded “louder.” An acceptable chi-squared statistical analysis revealed that listeners perceived 75% of the recordings from the LSVT group to be “louder” at 12 months follow-up while only 39% of the recordings from the RET group were perceived as “louder” at follow-up.

This level 1 study was the first of its kind to provide perceptual evidence for the long-term improvements in speech loudness among individuals with PD who received LSVT. The researchers made an appropriate choice in their listener selection by using a combination of naïve and experienced listeners, which makes these perceptual results more generalizable. However, the changes perceived in speech loudness within the LSVT group for the “The Rainbow Passage” may not carry over to perceptual changes in normal conversational speech. Despite the methodological concerns, this study provided novel perceptual information on speech loudness; therefore, the evidence was considered to be suggestive.

#### Longitudinal Study

Spielman et al. (2007) examined the long-term (6 months) impact of an extended version of the LSVT program (LSVT-X) on speech intensity compared to the traditional LSVT program in 12 individuals with PD. The extended version of the LSVT program

involves the standard 16 hours of therapy but it is spread out over an 8-week period and clients are required to complete a more rigorous home practice.

The results from the LSVT-X program were compared to the results from an LSVT PD group and a PD control group in a separate study conducted by Ramig et al. (2001b). Appropriate ANOVA statistical analysis and post hoc tests revealed a significant increase in speech intensity (~7.2 dB SPL) within the LSVT-X group from pre-treatment to 6 months follow-up for all speech tasks (sustained vowel phonation, “The Rainbow Passage,” “The Cookie Theft”) except conversational monologue. There was no significant difference in speech intensity between the LSVT-X and LSVT PD groups for all speech tasks at follow-up.

This level 2 study is important because the researchers recognize the inherent limitations in the volume of therapy sessions required for LSVT and wanted to find support for modifications to the program. The positive findings in support of the extended version of the LSVT program could have major implications for improving service delivery. It is not uncommon for historical control group data to be used in health research; however, it is preferable for the researchers to use control group data that is collected concurrently. Based on these criticisms, the evidence from this study was deemed to be suggestive.

### ***Discussion***

Overall, the evidence from the literature indicates that increases in speech intensity as a result of the LSVT program can be maintained to some degree in the long-term among individuals with idiopathic Parkinson’s disease.

Despite positive findings across studies, the results must be interpreted with caution because the developers of the LSVT program, Lorraine Ramig and Cynthia Fox, are responsible for a large majority of the research on LSVT. In the current critical appraisal, at least one of the developers appeared as an author in all of the articles reviewed, which may contribute to a bias in the research.

Another concern is the use of RET as the control group (Ramig et al., 1996; Ramig et al., 2001a; Ramig et al., 2001b; Sapir et al., 2002). While RET has a similar structure to LSVT and can improve voice and speech in PD, the decision to use RET is based on evidence that RET is inferior to the LSVT program (Ramig et al., 2001b; Sapir et al., 2002).

This raises major concerns over potential biases in these RCT studies despite the fact that using RET as a control is more rigorous than using no treatment (Ramig et al., 2001b). In addition, most of the speech intensity measures are part of the LSVT treatment protocol; therefore, differences between the LSVT and control group at follow-up may have been confounded by practice effects.

There are also some general concerns related to the methodology of the studies reviewed. There are inconsistencies in the inclusion of otolaryngological assessment, and the assessment of hearing and cognitive status. This is relevant because hearing loss, cognitive impairments, and speech/voice problems that are unrelated to PD could interfere with the efficacy of treatment and performance during data collection. Also, participants were not grouped based on stage of disease or speech and voice severity, which is important to note because the effectiveness of LSVT on speech intensity may vary depending on the stage and severity. However, using a diverse group of participants with idiopathic PD allows for the results from these long-term speech intensity studies to be generalizable to a broader range of individuals with idiopathic PD. Further methodological issues include the failure to use blinding of clinicians and listeners across all studies, and the absence of test-retest reliability measures for the participants and inter- and intra-rater agreement measures for the clinicians and listeners.

While the results from these LSVT studies are promising, the participants are producing “lab speech” or speech that is created in the artificial context of the lab environment. Therefore, it is difficult to determine how generalizable these speech intensity results are to normal conversation and real-life speaking environments.

An interesting trend that arose in this critical review is that the LSVT PD participants demonstrated a slight decline in speech intensity from post-treatment to follow-up. In addition, there are inconsistencies across studies in the conversational measures of speech intensity. Ramig et al. (2001a & b) found maintenance of increased speech intensity for conversation at follow-up, while other studies failed to find evidence for improvements in speech intensity for conversation at follow-up (Ramig et al., 1996; Spielman et al., 2007). Further research needs to be conducted to figure out possible solutions to this decrease in speech intensity from post-treatment to follow-up and the concerns with the long-term maintenance of speech intensity during conversation.

### ***Conclusion and Recommendations***

Overall, the LSVT group demonstrated a more consistent increase and maintenance of increased speech intensity levels in comparison to the RET control group. Based on these findings, the authors concluded that the LSVT program demonstrated support for the short and long-term improvement of speech intensity. The LSVT program currently provides the strongest evidence for improvement in communication among individuals with PD (Yorkston et al., 2007).

Future research should consider examining speech intensity in settings outside of the lab such as noisy environments, which can be especially problematic for individuals with hypophonic PD. It is worthwhile conducting studies using a treatment other than RET for the control group and more naturalistic speech tasks that involve typical conversational exchange. It would also be beneficial to investigate the impact of periodic post-treatment therapy sessions in order to refresh skills and prevent post-treatment decline in speech intensity. Additionally, research on LSVT needs to be conducted by individuals other than the creators of the program.

### ***Clinical Implications***

The results from the 5 studies included in this critical review indicate that the LSVT program is successful at increasing speech intensity, however, it can be challenging to maintain the increased levels of speech intensity in the long-term. Therefore, the LSVT program should be recommended with caution for both the short and long-term improvement of speech intensity in individuals with idiopathic PD. Clinicians should be cognizant that periodic therapy sessions after completion of the LSVT treatment program may be beneficial in order to ensure that treatment related gains in speech intensity are properly maintained.

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