

**Critical Review:**  
**Are there long-term benefits of Lee Silverman Voice Treatment on speech intensity in patients with Parkinson's Disease?**

Michelle Chung  
M.Cl.Sc (SLP) Candidate  
Western University: School of Communication Sciences and Disorders

This critical review investigates the long-term speech intensity effects of Lee Silverman Voice Treatment (LSVT LOUD) on patients with Parkinson's Disease (PD). The studies evaluated included one Single-Subject Study, two Randomized Clinical Trials, and two Non-Randomized Cohort Studies. Overall, all the studies yielded positive results demonstrating long-term benefits of LSVT LOUD on speech intensity in patients with PD.

### *Introduction*

Parkinson's Disease (PD) is progressive neurological disease where there is a "loss of dopaminergic cells in the Substantia Nigra (pars compacta), which leads to a reduced amount of dopamine released in the putamen (Adams, 2017). This affects the movements of the individual with PD with symptoms progressively worsening. In looking particularly at the speech symptoms, this leads to speech that is characterized by reduced loudness, reduced prosody, fast rate of speech, poor voice quality, and imprecise consonants (Adams, 2018). These speech symptoms can make it difficult for people with PD to communicate.

To investigate these communication issues, a study by Miller, Noble, Jones, & Burn (2006) looked at the self-perception of their speech, voice, and language changes in people with PD. They also looked at how these changes impacted their participation in family and community dynamics. They found that these speech, voice and language changes impacted the individual and their family life negatively long before intelligibility impairments were apparent to others. When questioned how speech changes were perceived, the individuals with PD reported a quieter, huskier, voice with deterioration in intelligibility perceived as mumbling, loss of clarity and a greater effort to maintain intelligible speech.

One type of speech treatment that aims to improve speech intelligibility by targeting vocal loudness is a trademarked program called Lee Silverman Voice Treatment LOUD (LSVT LOUD). More specifically, LSVT LOUD aims to stimulate high-effort productions with multiple repetitions through an intensive delivery model that will enhance sensory awareness of increased loudness and effort (Fox, Morrison, Ramig, & Sapir, 2002). In doing so, the increased vocal loudness from LSVT LOUD will prompt positive effects in other aspects of speech intelligibility like improved

articulation, vocal quality and intonation, and reduced rate of speech (Fox, Ebersbah, Ramig, & Sapir, 2012).

There are studies that examine the effectiveness of LSVT LOUD on vocal loudness in patients with PD, however, further investigation is needed to examine the long-term effects of the treatment. This critical review examines the following studies that look at long-term effects on vocal loudness in patients with PD.

### *Objectives*

The primary objective of this paper was to critically evaluate existing literature investigating the long-term effects of LSVT LOUD on speech intensity in patients with Parkinson's Disease (PD).

### *Methods*

#### Search Strategy

Online databases including PubMed, and PsychINFO (ProQuest) were searched using the following terms [(long-term effects) AND (LSVT) AND (Parkinson's)]. Additional papers were found by searching the reference lists of relevant articles.

#### Selection Criteria

The articles included in this review were required to examine long-term effects of LSVT LOUD in patients with PD. The studies investigated were required to measure aspects of speech intensity.

Studies using an extended or added version of LSVT LOUD (e.g., LSVT-X, LSVT-BIG, LSVT ARTIC, or LSVT RESP) were excluded from this review.

#### Data Collection

The literature search yielded five research papers that met the selection criteria. The studies reviewed included a Single-Subject Study, Randomized Clinical Trials (RCT) (2), and Non-Randomized Cohort Studies (2). All of the articles included a wide variety of outcome

measures, however, for the purpose of this review, variables relating to loudness will be the only measures examined.

### **Results**

**Standard LSVT protocol:** LSVT LOUD has a total of 16 1-hour sessions administered 4 times a week in 4 weeks (Mahler, 2015). The exercises consist of non-speech and speech drills (Sackley, 2018). The non-speech drills consist of maximum phonation of 'ah' and pitch glides of 'ah'. The speech drills are based on a hierarchy of single words to phrases to conversational speech, gradually increasing in vocal demand (Sackley, 2018). Sound Pressure Level (SPL) was used to measure vocal intensity in all LSVT LOUD tasks.

**Dromey, Ramig, and Johnson (1995)** examined a patient with PD in a single case study to investigate his voice and speech changes. The subject was a 49-year-old male representative of a patient in the early stage of PD. He was diagnosed with stage II IPD.

The authors included a wide variety of outcome measures, however, the only measure relevant to this review was speech intensity.

The patient underwent the standard LSVT LOUD protocol as their treatment. Data was collected twice within the week preceding the treatment and twice during the week following treatment. Data was also collected once at 6- and 12-months post-treatment with no other therapy in between. The tasks used to appropriately measure vocal intensity were: sustained vowels, reading, repetition of the /pae/ series, and a monologue.

Appropriate statistical analysis revealed increased vocal intensity in all tasks post-treatment and were maintained at 6- and 12-months post-treatment. The greatest improvements were seen in sustained phonation task.

Strengths of this study was measurement reliability for the phonatory function data. Appropriate statistical analysis revealed no significant difference between results in the first and repeated analyses. A limitation of this study was that the results were only taken from a single subject, therefore, individual factors could have influenced the results.

Overall, this study presents with highly suggestive evidence for the long-term speech intensity effects of LSVT LOUD in patients with PD.

**Miles, et al. (2017)** examined the effects of LSVT LOUD on a variety of outcome measures including pharyngeal swallowing parameters and reflexive cough

strength, however, for the purpose of this study, we will only look at speech intensity. This study was a non-randomized single-blinded cohort intervention study that used 20 participants with PD who had voice deterioration meeting the inclusion criteria for LSVT LOUD.

The patients received the standard LSVT LOUD protocol as their treatment. The measures used to assess the patients were the following tasks: sustained /a/, maximum phonation time (MPT), average intensity level in reading, and average intensity level in conversation. They were then assessed prior to treatment, 1-week post-treatment, and 6-months post-treatment of LSVT LOUD with no other therapy in between.

Appropriate statistical analysis revealed significant increase in MPT, average reading dB SPL, and average conversation dB SPL 1-week post-LSVT LOUD. All were maintained at 6-months post-treatment except for average conversation dB SPL. Follow-up at 6-months was not done for 3 participants due to travel issues to the radiology suite.

A strength of this study was the patients were blind to the measures being assessed while partaking in speech therapy. A limitation of this study was that it was not blinded so that constant interaction with the speech-language pathologist could have impacted the positive results on the self-report surveys. Additional limitations included small sample size, no control group and that the long-term follow up was confined to 6 months. Additionally, follow-up at 6-months was not done for 3 participants due to travel issues to the radiology suite.

Overall, the study presents with highly suggestive evidence that LSVT LOUD has long-term effects on vocal intensity in patients with PD.

**Ramig, et al. (1996)** used a Randomized Control Trial (RCT) study to examine the long-term effects of LSVT LOUD on vocal intensity of 35 patients with PD. Patients were randomly placed into one of two treatment groups: LSVT LOUD or a placebo therapy. LSVT LOUD was designed "to increase vocal fold adduction and loudness" (Ramig, et al., 1996) as patients underwent the standard LSVT LOUD protocol. The placebo therapy was designed to increase inspiration, expiration, and sustained expiration through respiratory muscle activity by allowing patients to increase their volumes and subglottal air pressure for speech. Both groups participated in the same amount of intensive, high-effort therapy.

The authors collected a wide range of data, however, for the purpose of this review, only the speech data was relevant. Experimental speech data was examined pre-treatment, 6-months post-treatment and 12-months post-treatment with no other therapy in between.

Appropriate statistical analysis revealed the LSVT LOUD group improved and maintained vocal intensity above the pre-treatment levels by 12-months post-treatment while the placebo group made some improvements right after the treatment, however, was unable to maintain those improvements at 12-months post-treatment. Additionally, the placebo group further deteriorated in vocal intensity at 12-months post-treatment below levels seen at pre-treatment.

Strengths of this study was the use of a control group with equal amount of intensive treatment and similar instructions. Furthermore, the placebo group also targeted self-monitoring output so that the impact of the combination of phonation and sensory self-monitoring that LSVT LOUD provided could be examined. A limitation of the study was the lack of subjects who were in the severe stages of PD as most of the patients were in the mild-to-moderate range of PD. Also, there were a few patients who were not followed up because of transportation issues.

Overall, this study showed somewhat suggestive evidence for the long-term effects of LSVT LOUD on vocal loudness in patients with PD.

**Ramig, et al. (2001)** investigated the long-term effects of LSVT LOUD in patients with PD in an RCT study. This study looked at 33 patients who were placed randomly into one of two treatment groups: LSVT LOUD or respiratory therapy (RET). The main goal for LSVT LOUD was to improve vocal fold adduction and overall laryngeal muscle activation in order to increase vocal efforts to improve loudness. Patients in this group underwent the standard LSVT LOUD protocol. The main goal for RET was to increase inspiratory and expiratory respiratory muscles in order to increase respiratory volumes, subglottal air pressure and loudness. Both types of treatment had the same amount of intensive, high-effort level sessions where patients were encouraged to perform at their maximum effort level throughout.

Experimental data was collected within a week before treatment, within a week after treatment, 6-months post-treatment, 12-months post-treatment, and 24-months post-treatment with no other therapy in between. SPL was used to reflect improvements in loudness and semitone standard deviation (STSD) was used to reflect improvements in inflection in voice fundamental

frequency. Both SPL and STSD were used to show improvements in vocal function as these acoustic variables are important for improving speech intelligibility.

Appropriate statistical analysis revealed the LSVT LOUD group improved in SPL and STSD from pre-treatment to 24-months post-treatment in the reading passage, monologue tasks, and sustained “ah” task. Appropriate statistical analysis showed no improvements from pre-treatment to 24-months follow up in the RET group. Additionally, patients in the RET group did not improve in SPL or STSD from pre-treatment to immediately post-treatment in all tasks except for the reading passage task.

Strength of this study was the multiple follow ups until 2-years post-treatment. Also, having the same amount of intensive and high effort treatment ensures the comparison between the two treatment groups was not due to other extraneous factors. A limitation of this study is the unequal group size and fewer women due to patient attrition.

Overall, the study presented with compelling evidence for long-term increased SPL and fundamental frequency effects of LSVT LOUD in patients with PD.

**Ramig, Sapir, Fox, and Countryman (2001)** examined the effects of LSVT LOUD on vocal loudness (SPL) in patients with PD. This RCT study compared the results to untreated patients with PD in order to determine whether long-term effects of LSVT LOUD were related to normal fluctuations in SPL associated with the disease or associated to the medication regimen. Patients were randomly placed in one of three groups: patients with PD receiving LSVT LOUD (14 subjects), patients with PD not receiving treatment (15 subjects), and individuals who were neurologically normal (NN) without PD and without voice and speech abnormalities (14 subjects). Patients in the LSVT LOUD group underwent the standard LSVT LOUD protocol. The subjects were not aware of the purpose of the study.

All groups were recorded once 2-weeks pre-treatment, twice immediately post-treatment, and twice 6-months post-treatment with no other therapy in between. Subjects were asked to complete the following tasks: sustained “ah”, reading passage, monologue of their choosing, and a description of the “Cookie Theft Picture”.

Appropriate statistical analysis revealed patients in the LSVT LOUD group increased in speech intensity in all tasks from pre-treatment to immediately post-treatment

and from pre-treatment to 6-months post-treatment. Appropriate statistical analysis revealed both the no treatment group with patients with PD and the group of individuals who were NN had the same results, not showing any changes in voice tasks done from baseline to immediately post-treatment and from baseline to 6-months post-treatment. Between the two groups with patients with PD (LSVT LOUD group and no treatment group), appropriate statistical analysis showed no significant differences in SPL at baseline for all tasks. At 6-months post-treatment, the LSVT LOUD group had significantly increased loudness in all tasks when compared to the no treatment group of patients with PD.

Strengths of this study included the addition of the task of describing the “cookie theft picture” in order to get speech of the patients when not focusing on their voice. An additional strength is that there was no treatment given to the other group with patients with PD because we can see the effects of LSVT LOUD are treatment-specific. However, this works as a limitation because the effects are not compared to another treatment with the same amount of intensive training. Another limitation this study has is the confinement of follow up to 6-months post-treatment.

Overall, this study has highly suggestive evidence that LSVT LOUD has positive long-term effects in patients with IPD on speech measures.

### ***Discussion***

The studies in this critical review all looked at long-term effects of LSVT LOUD on speech intensity in patients with PD. Overall, the results suggested positive long-term outcomes on speech intensity.

However, a limitation in the study by Dromey, Ramig, and Johnson (1995) was that the data was only taken from a single subject. The authors mentioned the subject’s attitude and emotional outlook as a possible explanation for the increased fundamental frequency in some of the speech tasks, which is a personal factor that can affect the results.

Additionally, Adams (2018) identified a few other key concerns with the LSVT LOUD protocol that all the studies included did not address.

The first concern of LSVT LOUD is the primary focus on low intensity to improve speech intelligibility in patients with PD. Low speech intensity is just one of many speech parameters that becomes abnormal as the disease progresses. The assumption with LSVT LOUD is that targeting loudness will carry over to other impaired speech parameters (Fox, Ebersbach, Ramig, &

Sapir, 2012), however, none of the studies examined precision of consonants, rate of speech, or hypernasality, which are a few of the other speech symptoms seen in patients with PD. However, there are further extensions of LSVT like LSVT ARTIC which uses “respiratory movements combined with instructions to enunciate or breathe deeply but no loudness instructions” (Adams, 2018). Further research should be done to investigate long-term effects on other speech parameters in patients with PD.

The second concern Adams (2018) mentions is the need to measure the effects of LSVT LOUD in outside settings with background noise. The LSVT protocol lacks this feature of placing a client in an outside setting. Instead, therapy and assessment take place in a quiet clinic room. Similarly, none of these studies attempt to assess patients outside of the clinical setting. A future research study should investigate long-term generalization by examining vocal loudness in outside setting with background noise.

The third concern Adams (2018) discusses is the assumption that low speech intensity in PD is due to laryngeal processes. LSVT LOUD does not address non-laryngeal processes that may be related to low intensity such as, respiratory, rate, or posture. As mentioned early, LSVT has additional extensions like LSVT RESP which targets respiratory processes rather than laryngeal, however, more research is needed to study the long-term efficacy in patients with PD.

### ***Clinical Implications and Recommendations***

Based on the positive current results, I would recommend to clinicians, administering LSVT LOUD in a clinical setting, however, I would caution them of the concerns discussed by Adams (2018). Further research to address the concerns of LSVT LOUD is needed to determine whether the positive long-term effects on speech intensity can be generalized to all abnormal speech parameters in PD and outside the clinic settings.

Another important consideration is the use of LSVT LOUD in other non-PD populations. A major concern is that of fatigue. For example, in Amyotrophic lateral sclerosis (ALS) is a rapidly progressing neurological disease. For a patient with ALS your goal is to conserve the energy so a treatment like LSVT LOUD would not work as it exerts energy. Furthermore, the vocal pushing technique in LSVT LOUD would be harmful for a patient with ALS. Instead, an augmentative and alternative communication approach is more appropriate.

With further research addressing the concerns of LSVT LOUD along with the positive long-term outcomes on

speech intensities found in the results of this study, LSVT LOUD can improve the speech intelligibility and therefore, the quality of life, of patients with PD.

Opinion in Otolaryngology & Head and Neck Surgery, 23(3), 209-215.

### References

- Adams, S. G. (2017). *Lecture 11 Hypokinetic Dysarthria 1 new 2017* [Powerpoint Slides]. Retrieved from <https://owl.uwo.ca/access/content/group/c5d1fc23-343b-4f9c-b211-d45188d92dcd/Powerpoint%20lectures/Lecture%2011%20Hypokinetic%20Dysarthria%20%20new%202017.ppt>
- Adams, S.G. (2018). *Lecture 13 CSD 9630 Hypokinetic Dysarthria 3 tx 2018* [Powerpoint Slides]. Retrieved from <https://owl.uwo.ca/access/content/group/c5d1fc23-343b-4f9c-b211-d45188d92dcd/Powerpoint%20lectures/Lecture%2013%20CSD%209630%20Hypokinetic%20Dysarthria%203%20tx%202018.pptx>
- Dromey, C., Ramig, L. O., & Johnson, A. B. (1995). Phonatory and articulatory changes associated with increased vocal intensity in parkinson disease: A case study. *Journal of Speech and Hearing Research*, 38(4), 751-764.
- Fox, C., Ebersbach, G., Ramig, L., & Sapir, S. (2012). LSVT LOUD and LSVT BIG: Behavioral treatment programs for speech and body movement in parkinson disease. *Parkinson's Disease*, 2012, 391946-12.
- Fox, C. M., Morrison C. E., Ramig, L. O., & Sapir, S. (2002). Current perspectives on the lee silverman voice treatment (LSVT) for individuals with idiopathic parkinson disease. *American Journal of Speech-Language Pathology*, 11(2), 111-123.
- Mahler, L. A., Ramig, L. O., & Fox, C. (2015). Evidence-based treatment of voice and speech disorders in parkinson disease. *Current*
- Miles, A., Jardine, M., Johnston, F., de Lisle, M., Friary, P., & Allen, J. (2017). Effect of lee silverman voice treatment (LSVT LOUD<sup>®</sup>) onswallowing and cough in parkinson's disease: A pilot study. *Journal of the Neurological Sciences*, 383, 180-187.
- Miller, N., Noble, E., Jones, D., & Burn, D. (2006). Life with communication changes in parkinson's disease. *Age and Ageing*, 35(3), 235.
- Ramig, L. O., Countryman, S., O'Brien, C., Hoehn, M., & Thompson, L. (1996). Intensive speech treatment for patients with parkinson's disease: Short- and long-term comparison of two techniques. *Neurology*, 47(6), 1496-1504.
- Ramig, L. O., Sapir, S., Countryman, S., Pawlas, A. A., O'Brien, C., Hoehn, M., & Thompson, L. L. (2001). Intensive voice treatment (LSVT<sup>®</sup>) for patients with parkinson's disease: A 2 year follow up. *Journal of Neurology, Neurosurgery, and Psychiatry*, 71(4), 493-498.
- Ramig, L. O., Sapir, S., Fox, C., & Countryman, S. (2001). Changes in vocal loudness following intensive voice treatment (LSVT<sup>®</sup>) in individuals with parkinson's disease: A comparison with untreated patients and normal age-matched controls. *Movement Disorders : Official Journal of the Movement Disorder Society*, 16(1), 79-83.
- Sackley, C. M., Smith, C. H., Rick, C. E., Brady, M. C., Ives, N., Patel, S., . . . PD COMM Pilot Collaborative Group. (2018). Lee silverman voice treatment versus standard speech and language therapy versus control in parkinson's disease: A pilot randomised controlled trial (PD COMM pilot). *Pilot and Feasibility Studies*, 4, 30.