Critical Review: Effectiveness of Voice Therapy for Adults with Unilateral Vocal Fold Paralysis

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This critical review examines the effectiveness of voice therapy in adults with unilateral vocal fold paralysis following intervention. The literature search resulted in five articles meeting the inclusion criteria. Study designs included: non-randomized clinical trials, single-group pre- and post-test designs, and a randomized clinical trial. The evidence gathered suggests voice therapy is beneficial for this patient population when implemented within one year of diagnosis. Recommendations for future research are provided.

Introduction

The recurrent laryngeal nerve (RLN) innervates the intrinsic muscles of the larynx, with the exception of the cricothyroid muscle, to control the movements of the vocal folds. When injury to the right or left branch of the RLN occurs, a pathology that may arise is unilateral vocal fold paralysis (UVFP): a disorder that causes glottic insufficiency (Havas et al., 1999). The paralyzed vocal fold is most often in a paramedian position (Schwarz et al., 2011), resulting in a breathy, quiet, and hoarse voice quality. Other complications of UVFP are difficulties coughing and swallowing, increased risk of aspiration, and frequent pauses during speech. Due to the vulnerable location of the RLN, surgeries of the neck and chest are the most common etiologies for UVFP (Spataro et al., 2014). Endotracheal intubation and tumors of the neck are other prevalent etiologies that occur when excessive pressure compresses the RLN (Spataro et al., 2014).

Treatment options for UVFP include voice therapy from a speech-language pathologist (SLP) or ambulatory surgical interventions (Walton et al., 2018). Voice therapy primarily consists of exercises to reduce compensatory behaviours for a louder voice by improving breath support, posture, and reducing tension within the vocal tract. Once this has been established, the SLP will consequently work with the patient to improve glottal closure by implementing exercises to move the mobile vocal fold towards the paralyzed one. During surgical interventions, glottal closure is achieved by forcibly bringing the paralyzed vocal fold towards the midline. Thyroplasty type I is a procedure in which a material is implanted through the thyroid cartilage to push the paralyzed vocal fold towards the midline. Similarly, injection medialization is another procedure in which a material is inserted into the paralyzed vocal fold to increase the volume until it reaches the midline.

While surgical interventions can rapidly reduce glottic insufficiency, a complication that may arise is difficulty breathing due to the partial obstruction of the upper airway. Furthermore, the results are not permanent and require follow-up procedures. Thus, voice therapy outcomes need to be clearly understood for physicians and clinicians in order to provide evidence-based recommendations regarding the treatment for UVFP.

Objectives

The primary objective of this paper is to critically evaluate the literature regarding the effectiveness of voice therapy in adults with UVFP.

Methods

Search Strategy

Computerized databases including PubMed, Google Scholar, and MEDLINE were searched using the following terms: (unilateral vocal fold paralysis) OR (UVFP) AND (voice therapy). To narrow the articles even further, the following filters were applied: Adults 19+ and published between 2005 and 2020.

Selection Criteria

Selected articles were required to investigate voice outcomes in patients with UVFP prior to and following voice therapy. Studies were excluded if they examined only one specific etiology (e.g., surgery) or comorbidity (e.g., Parkinson's disease). Additionally, both males and females had to be included in the statistical analyses, and studies that specifically compared demographic information (e.g., young vs geriatric patients) were excluded.

Data Collection

Results of the literature search yielded two non-randomized clinical trials, two single-group pre- and

post-test design studies, and one randomized clinical trial.

Results

Non-Randomized Clinical Trial Designs

Non-randomized clinical trials are an appropriate study design when examining voice disorders such as UVFP. The opportunity to have larger sample sizes increases the external validity for this type of study design; therefore, making it generalizable to other populations. Thus, non-randomized clinical trials are able to provide a moderate level of evidence for the adoption of potential treatment options.

Busto-Crespo et al. (2016) completed a prospective study comparing the effects of voice therapy in patients with UVFP when treated within (group 1: n=47) or after one-year (group 2: n=23) of diagnosis. Participants completed 15 half-hour, well-described voice therapy sessions over two months. Outcome measures completed pre-, post-, and at one-year follow-up included gold standard measures of voice handicap, maximum phonation time (MPT), conversational speech, glottal closure, and vocal hoarseness. Depending on the level of vocal hoarseness, additional measures of perturbation (fundamental frequency (F0), shimmer, jitter, and noise-to-harmonics ratio (NHR)) were completed (group 1: n=37; group 2: n=17). Results indicated that glottal closure improved to a greater extent for patients treated within rather than after one-year of diagnosis. No significant group differences were found for voice handicap or perturbation. At one-year follow-up, perturbation was unchanged, whereas vocal handicap improved significantly for group 1.

Strengths of this study included appropriate statistical analyses, selection criteria, and reporting of appropriate interrater reliability for relevant outcome measures. Limitations included the measurement of perturbation analysis for only a subset of participants, and the exclusion of patients at the one-year follow-up who received surgical interventions or additional voice therapy. As a result, less than 50% of the patients were re-examined at follow-up.

Overall, this study provides suggestive evidence that voice therapy within one-year of UVFP diagnosis results in improved glottal closure and reduced vocal handicap with the latter benefits observed over a one-year follow-up. Patients starting voice therapy one-year after diagnosis benefited in terms of hoarseness and voice handicap.

Mattioli et al.'s (2015) study compared voice therapy outcomes for patients with UVFP in either an early (n=78; therapy started within 4 weeks of onset), intermediate (n=44; therapy started 4 to 8 weeks from onset) or delayed treatment group (n=49; therapy started after 8 weeks from onset). Voice therapy consisted of 12 to 18 sessions of unknown duration over 2 to 3 months. Outcome measures completed pre- and post-therapy included standard assessment of glottal closure, motility, and morphology, evaluations of perturbation (jitter, shimmer, NHR, and F0), MPT, and ratings of hoarseness. Results indicated regaining of vocal fold motility in about two-thirds of patients, with most belonging to the early and intermediate groups. Glottal compensation for patients who did not regain motility occurred most frequently in the early and intermediate groups. MPT measures improved significantly in the early and intermediate groups. In patients who regained motility, perturbation improved significantly for the early and intermediate groups, whereas only NHR improved significantly in the delayed group.

Strengths of the study included appropriate statistical analyses, and a well described therapy program except for the lack of detail regarding the session duration. Additional limitations included no reporting of interrater reliability, lack of hoarseness measures at post-treatment analysis, no measures of voice handicap, and perturbation only for those who regained vocal fold motility. Thus, voice quality measures of perturbation should be interpreted with caution as they are not representative of all three treatment groups as a reporting bias is present.

Overall, this study provides equivocal evidence towards the effectiveness of voice therapy due to the numerous limitations that are present.

Single-Group Pre- and Post-Test Designs

A single-group pre- and post-test design is appropriate for assessing the effectiveness of a treatment for a population with an uncommon disorder. In the early stages of research, this information is important to obtain for developing future studies based on the examined group. While comparison groups are not present, these studies can still provide a moderate level of evidence.

Mattioli et al. (2011) examined the effects of voice therapy in patients (n=74) with UVFP who began therapy between 2 and 4 weeks of diagnosis. Voice therapy sessions of unknown duration were conducted twice a week for 10 weeks. Outcome measures completed pre- and post-therapy included standard assessment of glottal closure, voice handicap, MPT, ratings of hoarseness, and perturbation (jitter, shimmer, NHR, and F0). Results indicated that vocal

fold motility recovered in two-thirds of patients. For patients who did not regain vocal fold motility, glottal closure was sufficient for most individuals and significant improvements for MPT and voice handicap, along with perturbation in females, occurred.

Strengths of this study included appropriate statistical analyses, detailed outline of the voice therapy program, and exclusion of patients who regained vocal fold motility from the perturbation analysis to reduce type I errors by way of spontaneous recovery. Limitations included a small sample size of men, lack of interrater reliability scores, exclusion of post-therapy measures for hoarseness, and absence of detail regarding the duration of therapy sessions.

Ultimately, this study provides suggestive evidence that intervention commenced between 2 to 4 weeks of diagnosis can improve voice quality measures in female patients with UVFP.

Schindler et al.'s (2008) study examined voice quality outcomes in patients (n=40) with UVFP when treated between 20 and 30 days of diagnosis. Voice therapy consisted of 6 to 20 sessions of unknown duration and was individualized for each patient. Outcome measures completed pre- and post-therapy included MPT, glottal closure, voice handicap, ratings of hoarseness, perturbation analysis (jitter, shimmer, NHR, and F0), and ratings of perceptual qualities via the GIRBAS (grade, instability, roughness, breathiness, asthenia, and strain) scale. Results revealed the presence of glottal closure for more than half of the patients. Significant improvements were made for MPT, voice handicap, hoarseness, perturbation (except F0), and perceptual voice measures (except strain).

Strengths of this study included appropriate statistical analyses, inclusion of all post-therapy measures, and robust selection criteria. Limitations included lack of interrater reliability measures, and absence of a detailed therapy outline to provide a point of reference for replication.

The evidence put forth by Schindler et al. (2008) suggests that implementation of voice therapy for UVFP patients is effective in improving glottal closure and voice quality measures when commenced between 20 and 30 days of diagnosis.

Randomized Clinical Trial Design

A randomized clinical trial provides a high level of evidence for any given study. Since participants are allocated at random, many biases are reduced resulting in an increased amount of reliability for the findings.

Vij et al. (2017) examined voice quality outcomes in patients with UVFP after being randomized to either a surgical intervention (n=10) or voice therapy program (n=10) that began between 2 and 21 days of diagnosis. Participants completed 7 to 17 well-described, half-hour sessions over two months. Outcome measures obtained pre-therapy and three months post-therapy included standard measures of perturbation (jitter, shimmer, NHR, and F0), S/Z ratio, MPT, and both objective and subjective measures of dysphonia. For patients in the voice therapy group, results indicated significant improvements for MPT and perturbation (except for shimmer) in over two-thirds of patients. For patients in the surgical intervention group, results indicated significant improvements for MPT and all measures of perturbation in over two-thirds of patients. S/Z ratio and objective and subjective measures of dysphonia were similar for both groups.

Strengths included appropriate statistical analyses, strict selection criteria, computerized randomization of participants, and a well-described voice therapy program. Limitations included absence of glottal closure measurements for patients in the voice therapy group, lack of interrater reliability scores, and small sample sizes.

Overall, this study provides highly suggestive evidence that patients who begin voice therapy soon after diagnosis can attain similar voice quality outcomes as patients who receive surgical interventions.

Discussion

With the exception of Mattioli et al. (2015), the literature presented in this critical evaluation suggests that voice therapy can significantly improve voice quality outcomes in patients with UVFP. The articles displayed a moderate to high level of evidence based on their study designs, further strengthening the findings. The indication of an improved prognosis when voice therapy is implemented within one year of diagnosis is a critical finding.

Unfortunately, there are very few studies that examine longitudinal effects past one-year post-therapy. This information would allow physicians and clinicians to properly inform patients whether the effects from voice therapy will be long-lasting should the intervention be successful. Another limitation for this area of research is the lack of control for spontaneous recovery. A study conducted by Mau et al. (2017)

determined that spontaneous recovery most often occurs prior to six months post-diagnosis. When spontaneous recovery occurs, the patient regains vocal fold motility without any form of intervention. All studies reviewed examined patients prior to six months, suggesting the possible presence of type I errors if improvements were the result of spontaneous recovery. Due to the presence of variability amongst the research methods, there does not appear to be a cohesive and structured protocol for clinicians to follow when implementing voice therapy. There is a need for further randomized clinical trials in order to properly compare the effectiveness of voice therapy and surgical interventions, as Vij et al. (2017) appears to be the only researchers comparing the two. While it may be unethical in certain settings, randomized clinical trials would help eliminate biases, reduce confounding variables, and provide rigorous cause-effect relationships in improving UVFP.

Recommendations

Based on these limitations, future research should consider the following recommendations:

a) Studies that examine the longitudinal effects of voice therapy well past the one-year mark to provide patients with a long-term prognosis following intervention.

b) Implement control groups by having patients commence therapy at different points in time to reduce the possibility of type I errors from spontaneous recovery.

c) Recruit larger sample sizes for randomized clinical trials to increase the level of evidence comparing the effects of voice therapy to surgical interventions.

d) Generate a universal evidence-based protocol to develop a gold standard method of care for patients who choose to undergo voice therapy.

Clinical Implications

While certain limitations may exist, there is sufficient evidence presented within this critical evaluation demonstrating that patients with UVFP should undergo voice therapy soon after diagnosis to attain greater improvements in voice quality. Considering there is a decreased risk for potential side effects and similar voice outcomes between the two, voice therapy should be attempted prior to surgical interventions.

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