Clinical Practice Guideline: **Voice Therapy**

Date of Implementation: **June 6, 2017**

Product: **Specialty**

Related Policies:
CPG 165: Autism Spectrum Disorders
CPG 166: Speech-Language Pathology/Speech Therapy Guidelines
CPG 257: Developmental Delay Screening and Testing
CPG 287: Stuttering Devices and Altered Auditory Feedback (AAF) Devices
CPG 288: Augmentative and Alternative Communication (AAC) and Speech Generating Devices (SGD)

GUIDELINES

American Specialty Health– Specialty (ASH) considers voice therapy as medically necessary to restore the ability to produce speech sounds from the larynx for any of the following indications (see ICD-10 codes in chart below):

- Following surgery or traumatic injury to the vocal cords
- Following treatment for laryngeal (glottic) carcinoma
- Paradoxical vocal cord motion
- Functional (muscle tension) dysphonia
- Essential voice tremor
- Spastic dysphonia
- Vocal cord paralysis
- Symptomatic benign vocal fold lesions (cysts, nodules, and polyps)

ASH considers voice therapy NOT medically necessary for any of the following indications:

- Improvement of voice quality (e.g., hoarseness) without an underlying medical reason
- Self-limited conditions, such as acute laryngitis
- Occupational or recreational purposes

Maintenance treatment, where the member's symptoms are not improving, is considered not medically necessary. If no clinical benefit is appreciated after 4 weeks of voice therapy, then the treatment plan should be re-evaluated. Further voice therapy is not considered medically necessary if the member does not demonstrate meaningful improvement in symptoms.

ASH considers resonant voice therapy (e.g., Lessac-Madsen resonant voice therapy, and Lessac Y-Buzz) experimental and investigational because its effectiveness has not been established.

Note: Megaphones or amplifiers (e.g., ChatterVox, Mega Mite Megaphone) may be used in the absence of illness or injury and are therefore considered NOT medically necessary DME.

Note: Voice therapy for male-to-female transgender individuals to feminize the voice or for female-to-male transgender individuals to masculinize the voice is considered cosmetic.

ICD-10 Codes and Descriptions

ICD-10 Code	ICD-10 Code Description
F44.4	*Conversion disorder with motor symptom or deficit
G25.2	**Other specified forms of tremor
J38.00 - J38.02	Paralysis of vocal cords and larynx
J38.2	Nodules of vocal cords
S19.83XA, D, S	Other specified injuries of vocal cord
C32.0-C32.9	Malignant neoplasm of larynx
Z85.21	Personal history of malignant neoplasm of larynx

*****Medically necessary coverage includes functional dysphonia only.
******Medically necessary coverage includes essential tremors of the voice only.

DESCRIPTION/BACKGROUND

Vocal Cord Paralysis

Vocal cord paralysis is a voice disorder that occurs when one or both of the vocal cords (or vocal folds) do not open (abduct) or close (adduct) properly (NIDCD, 2017). Single vocal fold paralysis is a common disorder. Paralysis of both vocal folds is rare and can be life threatening as it may interfere with effective breathing support. When breathing, vocal

folds remain apart or abducted and when speaking and swallowing, they tightly close or adduct. With voice use, however, air from the lungs causes the vocal folds to vibrate between open and closed positions. Someone who has vocal cord paralysis often has difficulty swallowing and coughing because food or liquids are aspirated into the trachea and lungs. This happens because the paralyzed cord or cords remain open, leaving the airway passage and the lungs unprotected. Aspiration pneumonia becomes a real concern in this condition.

There are many possible causes of vocal cord paralysis including injury to the head, neck or chest after a blunt injury or surgery; tumors of both cancerous and noncancerous origins impact nerve function and vocal cord function; and stroke, viral infections, such as Lyme disease, and other neurological processes such as Multiple Sclerosis and Parkinson's disease effect the function of vocal cord movement. In many cases, however, the cause is unknown (NIDCD, 2017). In older people, vocal cord paralysis is a common problem affecting voice production. Individuals with vocal fold paralysis (one sided) typically experience changes in their voice, such as hoarseness or a reduction in volume. They may also have shortness of breath or noisy breathing and swallowing problems. Damage to both vocal folds, although rare, usually causes serious problems with breathing (NIDCD, 2017). Vocal cord paralysis is usually diagnosed by an otolaryngologist. Noting the symptoms the patient has experienced, the otolaryngologist will ask how and when the voice problems started in order to help determine their cause. The otolaryngologist listens carefully to the patient's voice to identify breathiness or harshness. Doctors will also look directly into the throat at the anatomy, vocal cord function, and vocal folds using an endoscope. Some doctors also use a procedure called laryngeal electromyography, which measures the electrical impulses of the nerves in the larynx, to better understand the areas of paralysis (NIDCD, 2017).

Common treatments for vocal cord paralysis include voice therapy and surgery. Surgical procedures are typically delayed for at least a year because people's voices may spontaneously recover. The initial course of care will be speech therapy with a speech-language pathologist who will provide exercises to strengthen vocal folds or improve breath control. They may also teach a person to change how they use their voice. This could be speaking more slowly or opening the mouth wider while speaking, which improves resonance and proper use of the vocal cords. Surgical procedure will depend upon whether one or both vocal folds are paralyzed. The most common surgical procedure is to change the position of the fold so that they are closer together or approximate for better voice quality. The result is usually a stronger voice. Additional voice therapy follows surgery, which may include vocal cord repositioning, implants or repairing damaged nerves (NIDCD, 2017). When both cords are paralyzed in the adducted position, breathing is usually the first priority. This is achieved by a tracheotomy. The patient then breathes through a tube directly inserted into the trachea in the anterior neck. Often post-surgical

speech therapy is needed to teach the patient how to care for the breathing tube and how to reuse their voice.

Laryngeal or Vocal Cord Nodules

Laryngeal or vocal cord nodules are noncancerous, callous-like growths on the inner parts of the vocal folds; usually caused by vocal abuse or misuse. These become larger and stiffer as the vocal abuse continues. Polyps can take a number of forms. They are sometimes caused by vocal abuse. Polyps appear on either one or both of the vocal cords. They appear as a swelling or bump (like a nodule), a stalk-like growth, or a blister-like lesion. Most polyps are larger than nodules and may be called by other names, such as polypoid degeneration or Reinke's edema. The best way to think about the difference between nodules and polyps is to think of a nodule as a callous and a polyp as a blister. Nodules and polyps can cause similar symptoms, such as hoarseness, breathiness, a rough or scratchy voice, and decreased pitch range. Chronic infections caused by allergies and inhalation of irritants, such as cigarette smoke, may also produce these lesions. Hoarseness and a breathy voice result. Carcinoma should be excluded by biopsy. Treatment for nodules that do not resolve with voice therapy involves surgical removal with direct laryngoscopy and correction of the underlying voice abuse. Vocal nodules in children usually improve with voice therapy alone. If voice abuse habits persist after therapy or surgery, the nodules can last a lifetime and may recur after surgical removal. Polyps usually resolve with rest for a few weeks; however, some may require surgery.

Patients are instructed to minimize voice use. This involves speaking no more than is absolutely necessary and avoiding any loud voice use or abuse. They are also instructed to avoid non-speech sounds such as throat clearing, coughing or sound effects. Patients are also instructed in how to engage in a short warm-up period of controlled, soft vocal exercises before using the voice. Patients may also be advised, where appropriate, to keep a supply of drinking water available at all times and to massage under their chin if their mouth becomes dry. Breathing exercises and changes in functional speech patterns and pitch, resonance, and respiratory coordination during speech are also integral to the treatment program. This includes speaking more slowly with clear articulation and comfortable pitch and volume. Posture is also a very important component from an education standpoint, with cues to avoid increased muscle tension. Dehydration, fatigue, and other general medical conditions can also have an effect on the mucosa covering the vocal cords, potentially altering lubrication and vocal efficiency.

Laryngitis due to viral infection usually resolves within 1 to 3 weeks. Laryngitis due to vocal abuse will generally resolve on its own in a few days with voice rest.

Paradoxical Vocal Fold Movement

Paradoxical vocal fold movement (PVFM) is a voice disorder. The vocal folds (cords) behave in a normal fashion almost all of the time, but, when an episode occurs, the vocal

cords close when they should open, such as when breathing. PVFM can be mistaken for asthma as it leads to wheezing and difficulty breathing, sometimes to the point of requiring hospitalization. Diagnosis of this condition is difficult due to variable symptoms and unpredictable episodes. A multi-disciplinary team of medical professionals is required for accurate diagnosis and treatment. A thorough medical history, including medications and smoking history. A laryngeal evaluation using endoscopy may also be completed. A voice evaluation by an SLP also aids in diagnosing this disorder. PVFM is treated both medically and behaviorally. Medical intervention addresses any physical and/or psychological factors. Behavioral intervention with a SLP includes vocal exercises, relaxation techniques, and proper breath support for speech. The goal of intervention is to make the individual aware of what triggers PVFM so they can avoid those situations. Triggers may include shouting or coughing, physical exercise, acid reflux, breathing cold air, inhalation of irritants such as pollen or smoking, psychological issues, and neurological issues. The person is also taught how to handle an episode when it occurs.

Spasmodic Dysphonia

Spasmodic dysphonia is a chronic (long-term) voice disorder. With spasmodic dysphonia, movement of the vocal cords is forced and strained resulting in a jerky, quivery, hoarse, tight, or groaning voice. It is characterized by involuntary movements of one or more muscles of the larynx. The first signs of spasmodic dysphonia are most often found in individuals between 30 and 50 years old. More women appear to be affected by spasmodic dysphonia than men. Vocal interruptions or spasms, periods of no sound (aphonia), and periods when there is near normal voice occur. Fluctuations of severity are also common. From an examination standpoint, a multi-disciplinary approach is recommended; including a SLP for voice production and quality evaluation, an otolaryngologist to examine the vocal cords and how they move, and a neurologist who will complete a neurologic evaluation. Currently there is no cure for spasmodic dysphonia. There are treatments that are helpful. Repeat injections of small doses of botulinum toxin (Botox) into one or both vocal cords are frequently recommended and performed by doctors. Botox weakens the laryngeal muscles allowing for a less forceful closing of the vocal cords. Treatment by an SLP may also be recommended following injections to optimize voice production. Psychological or psychiatric counseling is most useful when acceptance of the disorder and learning coping techniques are the desired goals. Career or vocational counseling may also be advised for persons who fear that the disorder threatens their occupation.

Laryngeal Cancer

Laryngeal cancer is a type of head and neck cancer. Laryngeal cancer forms in the tissues of the larynx (area of the throat that contains the vocal cords). The larynx includes the supraglottis, glottis (vocal cords), and subglottis. The cancer may spread to nearby tissues or to the thyroid, trachea, or esophagus. It may also spread to the lymph nodes in the neck, the carotid artery, the upper part of the spinal column, the chest, and to other parts of the body. Most laryngeal cancers form in squamous cells, the thin, flat cells lining the inside

of the larynx. Use of tobacco products and drinking too much alcohol can affect the risk of laryngeal cancer. These and other signs and symptoms may be caused by laryngeal cancer or by other conditions:

- A sore throat or cough that does not go away
- Trouble or pain when swallowing
- Ear pain
- A lump in the neck or throat
- A change or hoarseness in the voice

Certain tests and procedures may be used to diagnose laryngeal cancer. These include physical exam of the throat and neck, biopsy, laryngoscopy, endoscopy, barium swallow, MRI, bone scan, PET scan, and CT scan. Prognosis depends on the stage of the disease, location and size of the tumor, tumor grade, patient's age, gender, and general health. Treatment also depends upon the stage, location, and size of the tumor. Other things that may determine treatment options include whether it is a recurrence of cancer, keeping the patient's ability to talk, eat and breathe as normally as possible. Smoking and drinking alcohol can decrease the effectiveness of treatment.

Functional Voice Disorders

Functional voice disorders are characterized by the presence of vocal symptoms without anatomical laryngeal abnormality. Muscle tension dysphonia (MTD) is the most common disorder in this category. Muscle tension dysphonia (MTD) is a clinical and diagnostic term describing a spectrum of disturbed vocal fold behavior caused by either increased tension of the (para)laryngeal musculature or a lack of coordination. Supraglottic vocal hyperfunction (non-organic hyperfunction/dysphonia) and laryngeal hyperadduction are examples of MTD. Supraglottic hyperfunction is a learned behavior, often occurring after a viral upper respiratory infection. The individual will try to normalize their hoarse voice, creating the hyperfunction or dysphonia.

Essential Voice Tremor

Hyperkinetic dysarthria is characterized by abnormal involuntary movements affecting respiratory, phonatory, and articulatory structures impacting speech and deglutition. Speech production characterized by involuntary rhythmic modulation of pitch and loudness perceived as a shaky voice (i.e., vocal tremor) in those with essential tremor is referred to as essential vocal tremor (EVT). This disorder can occur in 30–40% of individuals with essential tremor or may be the primary sign of essential tremor. Approximately 90% of those presenting with EVT are female. Some individuals with EVT may report improved symptoms with ingestion of alcohol similar to the effect upon limb tremor. In addition, Individuals with mild EVT may not exhibit perceptible symptoms during connected speech tasks (e.g., reading sentences, or conversation), but their tempo may be slow. Thus, evaluation of EVT across speech contexts is important for determining severity level.

Further, changes in EVT severity should be evaluated across different pitch and loudness levels to determine conditions under which vocal tremor is improved or worsened.

Resonant Voice Therapy

Resonant voice is described as a pattern of voice use with oral vibratory sensations during easy voicing. The primary goal of resonant voice therapy is to achieve balanced oral-nasal resonance in an easy fashion to ultimately address a patient's voice complaints.

EVIDENCE REVIEW

Functional Voice Disorders

Roy (2003) stated that while voice therapy by an experienced speech-language pathologist remains an effective short-term treatment for functional dysphonia (FD) in the majority of cases, but less is known regarding the long-term outcomes of such intervention. The author stated that poorly regulated activity of the intrinsic and extrinsic laryngeal muscles is cited as the proximal cause of functional dysphonia, but the origin of this unregulated laryngeal muscle activity has not been fully explained. There are several potential causes of this imbalanced muscle tension. Roy stated, however, that research evidence points to specific personality traits as important contributors to its development and maintenance. Roy stated that further research is needed to better understand the pathogenesis of functional dysphonia, and factors contributing to its successful management. Overall, the state of the literature is of poor quality. Many studies lack a control group or are case reports. Systematic evidence reviews have cited the need for additional research into the effectiveness of voice therapy for MTD. Roy and Hendarto (2005) found no significant changes in mean speaking fundamental frequency (SFF) after manual circumlaryngeal therapy (MCT) in 40 women with functional dysphonia, despite subjective reports of improvement after therapy. To determine whether consistent directional and magnitude changes in SFF occur after management, pretreatment, and posttreatment audio recordings of 40 women with functional dysphonia were analyzed. Results indicated that, as a group, no significant change in mean SFF was observed after successful management. Although no consistent directional pattern was identified, 80% of the subjects experienced pitch changes greater than one semitone; this suggests that voice improvement is often accompanied by a shift in SFF.

Ruotsalainen et al. (2007) completed a Cochrane Database Systematic Review on interventions for treating functional dysphonia in adults. Authors sought to evaluate the effectiveness of interventions to treat functional dysphonia in adults. Randomized controlled trials (RCTs) of interventions evaluating the effectiveness of treatments targeted at adults with functional Dysphonia were included; six randomized controlled trials including a total of 163 participants in intervention groups and 141 controls. One trial was high quality. Interventions were grouped into 1) Direct voice therapy 2) Indirect voice therapy 3) Combination of direct and indirect voice therapy and 4) Other treatments: pharmacological treatment and vocal hygiene instructions given by a phoniatrist. No

studies were found evaluating direct voice therapy on its own. One study did not show indirect voice therapy on its own to be effective when compared to no intervention. There is evidence from three studies for the effectiveness of a combination of direct and indirect voice therapy on self-reported vocal functioning, on observer-rated vocal functioning and on instrumental assessment of vocal functioning when compared to no intervention. The results of one study also showed that the remedial effect remains significant for at least 14 weeks on self-reported vocal functioning and on observer-rated vocal functioning (Buffalo Voice Profile). There was also limited evidence from one study that the number of symptoms may remain lower for a year. The combined therapy with biofeedback was not shown to be more effective than combined therapy alone in one study nor was pharmacological treatment found to be more effective than vocal hygiene instructions given by a phoniatrist in one study. Authors noted that publication bias may have influenced the results. Authors concluded that evidence is available for the effectiveness of comprehensive voice therapy comprising both direct and indirect therapy elements. From a subject population standpoint, effects were similar in patients and in teachers and student teachers screened for voice problems. Larger and methodologically better studies are needed with outcome measures that match treatment aims. Commenting on the Cochrane review, Carding (2011) has stated that, "in contrast to popular opinion, the evidence base that underpins voice therapy practice remains incomplete and inconclusive".

Roy et al. (2009) studied whether articulatory changes in muscle tension dysphonia (MTD) occurred following manual circumlaryngeal therapy (MCT). Authors explored further the effects of MCT on vowel articulation by means of additional vowel acoustic measures. Pre- and post-treatment audio recordings of 111 women with MTD were analyzed acoustically using two measures: vowel space area (VSA) and vowel articulation index (VAI). Pairwise t-tests revealed significant increases in both VSA and VAI, confirming that successful treatment of MTD is associated with vowel space expansion. Although MTD is considered a voice disorder, its treatment with MCT appears to positively affect vocal tract dynamics. While the precise mechanism underlying vowel space expansion remains unknown, improvements may be related to lowering of the larynx, expanding oropharyngeal space, and improving articulatory movements. Dromey et al. (2008) examined whether acoustic evidence existed for articulatory changes after manual circumlaryngeal techniques (MCT) for patients with MTD, which supposedly alter the posture of the larynx and/or the configuration of the vocal folds without directly targeting supralaryngeal articulatory structures. Pre- and post-treatment speech samples from 111 women with MTD were analyzed for acoustic evidence of supraglottal vocal tract changes associated with voice improvement, which was confirmed by perceptual ratings of dysphonia severity. Authors concluded that these preliminary findings suggest that individuals with MTD experience changes in both articulatory and phonatory behavior following successful treatment that targets the larynx. In a systematic evidence review of voice therapy, Speyer (2008) reported that in general, statistically significant positive but modest and varying therapy effects are found. However, due to the small number of published treatment outcome studies and the

methodological heterogeneity and other issues among published studies, the conclusions of most studies cannot be generalized easily or compared to one another. Consequently, many issues in the field of effects of voice therapy have yet been unanswered.

Van Lierde et al. (2010) measured the dysphonia severity index in 10 subjects before and after treatment with 45 minutes of vocalization with abdominal breath support, followed by 45 minutes of manual circumlaryngeal therapy (MCT). The authors found no significant improvements in the dysphonia severity index before and after vocalization with abdominal breath support, and significant differences before and after MCT. Limitations of this study include its small size, pre-post design, lack of measurement of clinical outcomes, and lack of evidence on durability of treatment results. Mathesion (2011) completed a review of the current information about the types of laryngeal manual therapy in clinical use internationally and the evidence base for their use. The author suggests that there is evidence that laryngeal manual therapy, in various forms, can be a useful primary intervention in cases of muscle tension dysphonia, although this is based on very few studies. A higher level of evidence is required, including randomized controlled trials, to investigate its role in comparison with other interventions. Studies are also needed to verify or refute the clinical observation that it is also an effective treatment for all voice disorders, including those of organic etiology, when phonatory hyperfunction is a feature. Bos-Clark and Carding (2011) reviewed the recent literature since the Cochrane review regarding the effectiveness of voice therapy for patients with functional dysphonia. Authors noted that there was a range of articles reporting on the effects of voice therapy treatment for functional dysphonia. However, in the primary research, methodological issues persist: studies are small, and not adequately controlled. There is a need for larger, methodologically sound clinical effectiveness studies. Future studies need to be replicable and generalizable in order to inform and elucidate clinical practice.

Van Houtte et al. (2011) reviewed the research on the pathophysiology and treatment of muscle tension dysphonia addressing the causal and contributing factors of MTD and associated interventions. They reported that muscle tension dysphonia (MTD) is a clinical and diagnostic term describing a spectrum of disturbed vocal fold behavior caused by increased tension of the (para)laryngeal musculature. Recent knowledge introduced MTD as a bridge between functional and organic disorders. Results noted that etiological factors could be categorized into three subgroups: (1) psychological and/or personality factors, (2) vocal misuse and abuse, and (3) compensation for underlying disease. The effective treatment options for MTD were reported as (1) indirect therapy: vocal hygiene and patient education; (2) direct therapy: voice therapy and CMT; (3) medical treatment; and (4) surgery for secondary organic lesions. Authors concluded that MTD is the pathological condition in which an excessive tension of the (para)laryngeal musculature, caused by a diverse number of etiological factors, leads to a disturbed voice. Etiological factors ranged from psychological/personality disorders and vocal misuse/abuse to compensatory vocal habits in case of laryngopharyngeal reflux, upper airway infections, and organic lesions.

Eastwood et al. (2015) performed a systematic review of behavioral intervention for the treatment of adults with muscle tension voice disorders (MTVD). Seven papers met the inclusion criteria. Significant improvement on at least one outcome measure was reported for all studies. Effect sizes were small-to-large. Methodological qualities of research were varied. Outcome measures were used inconsistently and less than half of the measures had reported reliability values. Confidence in the accuracy of subject diagnosis on average was rated as low. Specific "active ingredients" for therapeutic change were not identified. Authors concluded that voice therapy for the treatment of MTVD is associated with positive treatment outcomes; however, there is an obvious need for systematic and high-quality research designs to expand the evidence base for the behavioral treatment of MTVD. In a randomized, blinded clinical trial, Pedrosa et al. (2016) evaluated the effectiveness of the Comprehensive Voice Rehabilitation Program (CVRP) compared with Vocal Function Exercises (VFEs) to treat FD. A total of 80 voice professionals who presented with voice complaints for more than 6 months with a FD diagnosis were included in this study. Subjects were randomized into 2 voice treatment groups: (i) CVRP and (ii) VFE. The rehabilitation program consisted of 6 voice treatment sessions and 3 assessment sessions performed before, immediately after, and 1 month after treatment. The outcome measures were self-assessment protocols (Voice-Related Quality of Life [V-RQOL] and Voice Handicap Index [VHI]), perceptual evaluation of vocal quality, and a visual examination of the larynx, both blinded. The randomization process produced comparable groups in terms of age, gender, signs, and symptoms. Both groups had positive outcome measures. The authors concluded that both treatment programs were effective; and the probability of a patient improving because of the CVRP treatment was similar to that of the VFE treatment. However, these conclusions should be considered with caution given both groups received an active treatment.

da Cunha Pereira et al. (2018) carried out a systematic review of the effects of voice therapy on individuals diagnosed with muscle tension dysphonia (MTD) or hyperfunctional dysphonia. Of the 634 publications, 12 studies were included in this review of which three were excluded due to a low quality, resulting in a final number of nine publications. Regarding the techniques approached, semioccluded vocal tract exercises (22.22%), nasal sound and frequency modulation (22.22%), maximum phonation time (MPT) technique and vocal hygiene (11.11%), vocal function exercises (11.11%), respiratory exercises along with phonoarticulatory sounds (11.11%), manual laryngeal therapy (11.11%), and manual laryngeal therapy associated with respiratory exercises (11.11%) were identified. These techniques promoted the following effects: improvement in intraoral and subglottal pressure, positive alterations in the glottal contact quotient, significant changes in fundamental frequency measures, increased MPT, and reduced voice roughness. Methodology was identified to be a shortcoming in the studies. The clinical trials reviewed showed positive results in using the therapeutic techniques selected in the speech therapy approach.

Meerschman et al. (2019) studied the dosage of voice therapy comparing and proposing that short-term IVT (short term intensive therapy) as equally effective in treating patients with dysphonia as long-term TVT (traditional voice therapy). Forty-six adults diagnosed with dysphonia were followed in 3 groups. A multidimensional voice assessment consisting of both objective (maximum performance task, aerodynamic measurements, voice range profile, acoustic analysis, multiparametric voice quality indices) and subjective IVT made an equal progress in only 2 weeks and 12 hours of therapy as compared with TVT that received 6 months and 24 hours of therapy. Group treatment seemed as effective as individual treatment. Follow-up assessments showed improved vocal quality and capacities remained stable till 1-year follow-up, suggesting transfer of learned skills. The psychosocial well-being inconsequently deteriorated in the IVT-I group at follow-up. Session attendance was clearly higher in IVT compared with TVT, a factor that is imperative for successful therapy outcomes. Cost-effectiveness is an important advantage of IVT. The golden mean between intensive and traditional treatment might be an achievable, effective, and efficient solution for everyday clinical practice.

Hseu et al. (2021) completed a retrospective review of patients treated with virtual voice therapy from April 2020 to June 2021. Patients were included if diagnosed with vocal fold nodules, 2-18 years of age, and completed therapy in a virtual format. Data includes demographics, Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) scores and pediatric Voice Handicap Index (pVHI) scores. Twenty-three children were included, 17 (74%) male and six (26%) female (with an age range of 2.4-9.9 years at the start of therapy). Prior to treatment, the average CAPE-V Overall Severity score was 37.9 (SD 13.8); the average posttreatment score was 22.4 (SD 10.2). The average pVHI total score prior to treatment was 26.3 (SD 12.1), with an average posttreatment score of 20.2 (SD 11.7). Patients who underwent virtual voice therapy had improved posttreatment CAPE-V severity scores than those prior to treatment. An increased number of therapy sessions was associated with both higher initial CAPE-V severity scores and a greater decrease in posttreatment CAPE-V scores. Virtual voice therapy may be feasible and efficacious in treating dysphonic children diagnosed with vocal fold nodules. Improvements were found in perceptual CAPE-V scores in overall severity and positive changes in parental measures of quality of life. Delivery of voice therapy in a telehealth format may increase access to care and should be considered as a treatment option. The treatment of pediatric dysphonia was shown to be an effective treatment as noted by the objective outcome measure changes in this study and the option of teletherapy expanded the availability of services.

Ahmadi et al. (2022) investigated the effects of breathing exercises combined with manual therapy versus breathing exercises or manual therapy alone on voice quality in traditional singers suffering from MTD. In this blinded randomized clinical trial, 60 patients with MTD were randomly allocated to four groups: (1) breathing exercises, (2) manual therapy, (3) combined intervention (CI) and (4) control. Patients received treatments for 13 sessions, once per week. Treatment effects were assessed in terms of primary outcome

measures: (1) breathing performance, measured by maximum phonation time (MPT) and (2) laryngeal function, measured by Stroboscopy Evaluation Rating Form (SERF). Secondary outcome measure was patient's self-perceived voice handicap, measured by Persian version of Singing Voice Handicap Index (SVHIp). Three treatment groups had improved regarding breathing performance, laryngeal function, and voice handicap over the time ($P < 0.01$). The improvements achieved in all outcomes were significantly greater in the CI group than those of the breathing exercises, manual therapy, and control groups. Authors concluded that this randomized controlled trial showed that the combination of breathing exercises and manual therapy significantly improved the laryngeal function, breathing performance and voice handicap in traditional singers suffering from MTD.

Laryngeal Cancer

Voice therapy has been shown to be effective in rehabilitating persons treated for early glottic carcinoma. van Gogh et al. (2006) did a randomized and controlled study to assess the efficacy of voice therapy in these patients. Of 177 patients, 6-120 months after treatment for early glottis carcinoma, 70 patients (40%) suffered from voice impairment based on a 5-item screening questionnaire. Approximately 60% of those 70 patients were not interested in participating in the current study. Twenty-three patients who were willing to participate were assigned randomly either to a voice therapy group (n= 12 patients) or to a control group (n = 11 patients). Statistical analyses of the difference in scores (post measurement minus premeasurement) showed significant voice improvement after voice therapy on the outcome measures. Authors concluded that voice therapy proved to be effective in patients who had voice problems after treatment for early glottic carcinoma. Improvement not only was noticed by the patients but also was confirmed by objective voice parameters. van Gogh et al. (2012) followed up with a pilot study on the long-term efficacy of voice therapy in the same patients from the earlier study with voice problems after treatment of early glottis cancer. In this prospective study, 12 patients, selected based on a screening questionnaire about voice problems and randomly assigned for treatment with voice therapy (vs no treatment), were evaluated with a mean of 13 months after finishing voice therapy to evaluate the long-term voice effects. Statistical analysis showed that the beneficial short-term effect on outcomes remained stable after more than a year of follow-up. Authors concluded that the present study provides initial evidence that the beneficial effect of voice therapy is not just a short-lived voice improvement but may result in a better voice for a period of at least 1 year. Future long-term randomized controlled trials are needed to confirm findings.

Bergström et al. (2017) studied voice rehabilitation after laryngeal cancer and the associated effects on psychological well-being. Authors noted that although voice rehabilitation has shown to improve functional outcomes and positively affect health-related quality of life, to date, there has been limited study of the associated effect of behavioral voice intervention on psychological well-being/distress post laryngeal cancer. Sixty-three patients with laryngeal cancer treated with (chemo)radiotherapy were

prospectively recruited and randomized to either a voice rehabilitation (VR, *n* = 31) or control group (*n* = 32). The VR group received 10 speech pathology sessions consisting of both direct and indirect voice intervention post (chemo) radiotherapy. The control group received general voice education but not specific intervention. The authors reported that the positive correlations and between-group analyses indicate a positive effect on psychological well-being associated with completing voice rehabilitation. Results highlight potential additional benefits of behavioral voice intervention beyond achieving direct change to voice function.

Millgard and Tuomi (2020) aimed to investigate the short-term and long-term effects of voice rehabilitation in patients treated with radiotherapy for laryngeal cancer as measured by both the acoustic measure smoothed cepstral peak prominence (CPPS) and perceptual measures. A secondary aim was to investigate the relationship between acoustic and perceptual measures. In total, 37 patients received voice rehabilitation post-radiotherapy and 37 patients constituted the irradiated control group. CPPS values of the voice rehabilitation group and vocally healthy group were not significantly different at 24 months post-radiotherapy. Ten out of 19 patients who received voice rehabilitation yielded a CPPS value above the threshold for normal voice 24 months post-radiotherapy, compared to 11 out of 26 in the irradiated control group. Authors concluded that voice rehabilitation for irradiated laryngeal cancer patients may have positive effects on voice quality up to 24 months post-radiotherapy. Karlsson et al. (2021) reported on the effectiveness of voice rehabilitation following radiotherapy for laryngeal cancer in a long-term perspective, i.e., up to three years after completion of radiotherapy. The study included a total of 74 patients that were randomized into an intervention group (*n* = 37) or a control group (*n* = 37). Voice rehabilitation was performed in 10 sessions immediately following completion of radiotherapy. Patients also filled out the Swedish Self-Evaluation of Communication Experiences after Laryngeal (S-SECEL) cancer. The S-SECEL demonstrated statistically significant improvements in the intervention group when comparing baseline and 36 months, and no changes in the control group. The perceptual analysis demonstrated that when comparing the changes within the groups between baseline and 36 months there were statistically significant differences between the intervention and control group regarding the voice qualities Roughness, Breathiness and Strain. In the control group, 50% demonstrated deterioration in roughness, while in the intervention group only 7% deteriorated during this time. In Breathiness and Strain, 57% and 50%, respectively, improved in the intervention group, while only 32% and 23% improved, respectively, in the control group. Authors concluded that voice rehabilitation following radiotherapy for laryngeal cancer demonstrates positive effects in patient reported outcomes and perceptual measures of voice quality, and the effects remain up to three years following radiotherapy.

PVFM

The mainstay of treatment for paradoxical vocal fold motion involves teaching the patient vocal cord relaxation techniques and breathing exercises. Patel et al. (2015) completed an

evidence-based systematic review on the effects of SLP treatment for individuals with PVFM. Sixty-five articles met the search criteria. Only 2 out of the 65 articles were judged to contain adequate evidence to evaluate the effect of SLP treatment for PVFM. All 65 articles exemplify the state of the evidence for SLP treatment for PVFM. Authors conclude that the state of the evidence for the use of SLP treatment is in the early stages, with a majority of articles in the exploratory stage of research. Consequently, few clinical implications can be drawn at this time. SLP treatment for PVFM is promising; however, there is clearly a pressing need for systematic experimental studies that involve a control group to further the evidence base. Vance et al. (2020) sought to determine characteristics of patients with confirmed PVFM and to evaluate efficacy of current treatments. Treatment for laryngopharyngeal reflux (LPR) was used only when there was evidence of LPR; and 93% of the 40 patients received LPR treatment. Ninety percent of patients who received botulinum toxin, voice therapy (VT), and LPR treatment had subjective improvement. Patients with just VT and LPR treatment had a 43% subjective improvement rate; and the difference was statistically significant at P of 0.021. There was no statistical difference between VT and LPR treatment versus VT or LPR treatment alone. Authors concluded that Botulinum toxin, VT, and LPR treatment regimen is currently the most effective management for patients with paradoxical vocal fold movement disorder.

Malaty and Wu (2021) described vocal cord dysfunction management. Vocal cord dysfunction (i.e., vocal cords closing when they should be opening, particularly during inspiration) should be suspected in patients presenting with inspiratory stridor or wheezing; sudden, severe dyspnea (without hypoxia, tachypnea, or increased work of breathing); throat or chest tightness; and anxiety, particularly in females. Common triggers include exercise, asthma, gastroesophageal reflux disease, postnasal drip, upper or lower respiratory tract infection, and irritants. Nasolaryngoscopy and pulmonary function testing, with provocative exercise and methacholine, can help diagnose vocal cord dysfunction and are helpful to evaluate for other etiologies. Conditions that can trigger vocal cord dysfunction should be optimally treated, particularly asthma, gastroesophageal reflux disease, and postnasal drip, while avoiding potential irritants. Therapeutic breathing maneuvers and vocal cord relaxation techniques are first-line therapy for dyspnea that occurs with vocal cord dysfunction. A subset of vocal cord dysfunction leads to dysphonia, as opposed to dyspnea, secondary to abnormal laryngeal muscle spasms (vocal cord closure is less severe). OnabotulinumtoxinA injections may be helpful for spasmodic dysphonia and for treating dyspnea in certain cases, although evidence is limited.

Jacks et al. (2021) compared presenting symptoms, etiology, and treatment outcomes among dysphonic adults <65 and ≥65 years of age. A total of 755 patients presenting for dysphonia were included in the study: 513 adults <65 years of age and 242 adults ≥65. Data collected included demographics, referral information, prior diagnoses, prior treatments, clinical examination findings, diagnosis, coexisting symptoms, treatments, and pre- and postintervention Voice Handicap Index scores. The most common etiologies of dysphonia

were vocal cord atrophy (44.8%) in the ≥65 cohort and benign vocal cord lesions (17.8%) in the <65 cohort. When compared with adults <65 years old, patients ≥65 had a higher incidence of neurologic dysphonia (P = .006) and vocal cord atrophy (P < .001) but were less likely to have laryngopharyngeal reflux (P = .001), benign vocal cord lesions (P < .001), or muscle tension dysphonia. Overall, 139 patients had surgery, 251 received medical therapy, and 156 underwent voice therapy. The ≥65 cohort demonstrated improvement in Voice Handicap Index scores after surgery and voice therapy, as did the <65 cohort. Adult surgical patients <65 reported greater improvements than patients ≥65. Authors concluded that there are notable differences in the pathophysiology of dysphonia between patients aged ≥65 and <65 years. Although adults <65 reported slightly better outcomes with surgery, patients ≥65 obtained significant benefit from surgery and voice therapy.

Fujiki et al. (2022) examined treatment duration and factors predicting number of therapy sessions required. Patients completed an average of 3.4 therapy sessions before discharge. Comorbid behavioral health diagnosis and a history of upper airway surgeries were significant predictors of the number of therapy sessions required before discharge; both factors significantly increased therapy duration. Age, symptom trigger-type, reflux symptoms, and dysphonia did not predict therapy duration. Overall, their regression model accounted for 42% of the variance in number of sessions required. On average, 3.4 sessions of therapy with an SLP resolved PVFM symptoms. Children with a behavioral health diagnosis required an average of 5.45 sessions and those with a history of upper airway surgery an average of 4.3 sessions. Future work should examine the relationship between behavioral health care and PVFM treatment, as well as how PVFM treatment efficiency can be maximized.

Vocal Cord Paralysis

Walton et al. (2016) completed a systematic review of SLP management on unilateral vocal fold paralysis (UVFP). Voice therapy provided by a speech-language pathologist is designed to maximize vocal function and improve quality of life. The purpose of the paper was to systematically review literature surrounding the effectiveness of speech-language pathology intervention for the management of UVFP in adults. Of the 3,311 articles identified, only 12 met the inclusion criteria: seven case series and five comparative studies. All 12 studies subjectively reported positive effects following the implementation of voice therapy for UVFP; however, the heterogeneity of participant characteristics, voice therapy, and voice outcome resulted in a low level of evidence. Authors concluded that there is a lack of methodological rigor and clinical efficacy in the speech-language pathology management of dysphonia arising from UVFP in adults. Problems with research interpretation included the variability of SLP interventions, assessment battery and clinical presentation. Further research is required to develop the evidence for the management of UVFP incorporating controlled treatment protocols and more rigorous clinical methodology.

Alegria et al. (2021) aimed to estimate the efficacy of voice treatment on the vocal fold motility in adult patients with unilateral vocal folds paralysis in a meta-analysis. After applying the inclusion and exclusion criteria a total of 10 studies containing morpho-functional evaluation results were included in the analysis. Pooled data analysis of the motility of the vocal folds before and after voice therapy allowed inferring about the efficacy of voice therapy intervention in patients with unilateral vocal folds paralysis. The pooled data analysis of the visual-perceptual measures revealed that vocal fold motility improved in 72% of all patients after the therapeutic interventions. Authors concluded that this meta-analysis supports the evidence that voice therapy intervention can have a positive effect on the vocal fold motility, that is, they can improve the glottal gap closure, irrespective of the exercises and techniques used. Santos et al. (2021) used a multidimensional assessment to analyze potential influence of "aging" in the functional outcomes achieved by a group of patients with recent onset of unilateral vocal fold paralysis (UVFP) who underwent voice therapy. A total of 100 patients (76 females and 24 males) with UVFP were included. Mean age was 61.04 years (range: 21-88 years). The mean score of VHI, before and after voice therapy, was statistically different with a lower score after therapy. The score of VHI was not influenced by age. However, for each 10-year increase in age, the score of VHI, before and after voice therapy, increased 1.91 and 2.86 units, respectively. Authors concluded that a clear and significant improvement was visible in the endoscopic and self-assessment ratings after rehabilitation by isolated voice therapy. Despite possible anatomical and physiological aging changes in the phonatory system, age did not compromise the successful rate obtained by voice therapy.

Essential Voice Tremor and Spasmodic Dysphonia

Barkmeier-Kraemer and Clark (2017) review evaluation and treatment approaches by SLPs for addressing impaired speech and deglutition in specific hyperkinetic dysarthria populations. Strategies for addressing compromised speech and intelligibility. Spasmodic dysphonia and essential voice tremor have been studied more thoroughly than other hyperkinetic speech impairments and are also the disorders for which speech therapy is most often sought by patients and requested by physicians. Authors note that individuals showing mild vocal tremor or the ability to reduce their voicing duration may be candidates for speech treatment. Current speech treatment approaches with EVT are limited to case-based publications with one reporting benefit from shortening voicing duration during speaking combined with improved respiratory–phonatory coordination. Shortened voicing duration reduces perception of vocal tremor by disrupting the cyclic modulation of the voice. Improved respiratory–phonatory coordination aims to reduce speech structure muscle tension levels. Thus, methods found effective in reducing throat and voicing tension include the use of increased airflow and reduced effort levels during talking. Speech therapy may reduce the impact of hyperkinetic dysarthria on functional communication and the effort associated with speaking. However, speech therapy does not cure hyperkinetic dysarthria and, as such, is often paired with the preferred practice of BTN injection in the management of dystonia and tremor.

Wagle Shukla (2022) reviewed the history and physical examination features pertinent for diagnosis, differential diagnoses, and treatments and approaches for optimal control of symptoms. A detailed history with open-ended questions and focused questions encompassing medical history, social history, and family history is key for establishing the diagnosis. The presence of bilateral action tremor for 3 years and absence of isolated head and voice tremor and absence of task- and position-dependent tremor are necessary for diagnosis. Dystonic tremor, Parkinson disease tremor, physiologic tremor, and drug-induced tremor are common differential diagnoses. Differentiating these tremor disorders from essential tremor based on phenomenology and physical examination alone could be challenging; thus, clinicians should seek additional clues from a detailed history. Treatment could begin with noninvasive and nonpharmacologic therapies, especially in mild cases. As the severity increases, they can advance stepwise to include pharmacotherapies and surgical interventions. With the growing recognition that essential tremor is not a monosymptomatic disorder, management should involve a multidisciplinary team. Furthermore, treatment selection should be based on shared decision making between patients and providers that gives due consideration to severity of symptoms, level of functional disability, impact on social interactions, patient preferences, and patient expectations.

Sanuki (2023) reviewed the literature for the pathogenesis, clinical characteristics, treatment options, and current management methods of spasmodic dysphonia (SD). Technological advances have enabled clinicians to better understand the connection between laryngeal function and dysfunction. Refinements in imaging and genetic investigation techniques have helped better understand the underlying mechanisms of this neurolaryngology disorder. Currently, the standard of care for SD is the symptomatic management of botulinum toxin (BT) chemodenervation. This is supported by a large body of literature attesting to its efficacy in many different research studies, particularly in the uncomplicated adductor form of the disorder. Efforts towards surgical treatment predate the development of BT treatment by a decade, but the long-term efficacy has not been proven and, further research is expected. Symptom relief in patients with abductor SD and dystonia with tremors after surgical and BT treatments and those in patients remains suboptimal.

Benign Vocal Cord Lesions

Tibbetts et al. (2018) performed a retrospective review of the demographics, treatment approach, and outcomes of patients treated for vocal fold cysts between 2009 and 2014. Twenty-five patients were identified, and one was excluded for incomplete records. Microflap excision was pursued by 21/24 (87.5%) patients, with 14 patients (58.3%) undergoing perioperative voice therapy. One cyst recurred. Two patients elected for observation, and their cysts persisted. Cysts were characterized as mucus retention cysts in 19/21 (90%) and as epidermal inclusion cysts in 2/21 (10%). Authors concluded that vocal fold cysts impact mucosal wave and glottic closure. Surgical excision resulted in low rates

of recurrence, and in improvement in the mucosal wave and VHI-10. Perioperative voice therapy did not offer a significant benefit. Ogawa and Inohara (2017) conducted a review of the most recent literature on the therapeutic effects of voice therapy, vocal hygiene education or direct vocal training on vocal quality, the lesion appearance and discomfort felt by patients due to the clinical entity of benign vocal fold mass lesions. Based on their findings, authors concluded that evidence remains insufficient to support the use of voice therapy against benign vocal fold lesions. White (2019) aimed to present current perspectives on the management of BVFLs, particularly exploring the role of voice therapy in a review article. They determined that primary voice therapy can frequently prevent surgery in vocal fold nodules and some types of polyps. Used as an adjunct to phono-surgery, preoperative and postoperative voice therapy can improve patient-reported outcomes and acoustic parameters of the voice. However, heterogeneity of studies and poor descriptions of intervention components prevent a robust analysis of the impact of voice therapy. Authors summarized that the current evidence consists of low-level studies using mixed etiology groups, which compromises internal and external validity. Poor reporting and heterogeneous methodologies lead to difficulties determining the components of a voice therapy intervention for this population. Consequently, they were unable to evaluate which intervention elements are beneficial to patients.

Alegria et al. (2020) completed a narrative review with a systematic search of the current literature about the effectiveness of voice therapy interventions in adults with vocal fold nodules. Nine out of 30 reviewed articles met the criteria of inclusion and reported positive effects of voice therapy intervention on adult patients with vocal fold nodules. The vast majority of the reviewed studies reported multidimensional voice measures outcome data, most of them containing visual-perceptual, auditory-perceptual, acoustic and self-assessment results. Regardless of receiving direct or indirect or a combination of both voice therapy contents, nearly all voice quality parameters were found to improve after treatment. Short-term treatment (< 3 weeks) may be as beneficial as longer traditional voice therapy programs and using telepractice voice therapy may be an achievable and practical way of delivering treatment and enhance adherence to therapy. The study design and the evidence levels of the included studies were low (≤ III-2) and the risk of bias of the comparative studies was moderate. Authors reported that this narrative review cannot conclude the general effectiveness of voice therapy programs. Further research and understanding of what specific parameters (exercise and techniques) of a therapy's content will improve voice outcome measures. More studies are required to investigate if voice therapy benefits are sustainable 6 months after ending the therapy. However, improved evidence is required to suggest that short period treatments are as beneficial as traditional therapy programs.

In a qualitative interview study, White and Carding (2022) described factors influencing the content, timing, and intensity of pre- and post-operative voice therapy for patients undergoing phono-surgery for benign vocal fold lesions. These investigators also attempted to understand experts' rationale for decisions made; and analyzed factors

influencing intervention in relation to the wider literature in order to contribute to the development of a complex intervention. Participants included 10 expert voice therapists with a mean of 22-year experience. Participants were asked to describe factors influencing their current practice and views on optimum treatment for patients undergoing phono-surgery for benign vocal fold lesions. Data were analyzed using the Framework Method of thematic analysis. Factors influencing intervention related to 4 key themes -- pathophysiological, patient, therapist, and service factors influenced the content, timing, and duration of the voice therapy provided. Consensus on core elements included delivering indirect and direct therapy pre-operatively to manage underlying causative factors and address patient expectations. Post-operative intervention focused on indirect therapy to facilitate wound healing and direct therapy to improve vibratory characteristics of the vocal fold. Elements of therapy were highly individualized within participants according to the 4 themes above; however, similarity between participants on broad parameters of intervention was high. The authors concluded that expert voice therapists use direct and indirect methods pre- and post-operatively to treat patients with benign vocal fold lesions. Optimizing wound healing and mobilization of the epithelium post-operatively are concerns for expert voice therapists which distinguish post-operative patients from other dysphonic patients. This study provided an insight into the factors influencing clinician's intervention provision that could contribute to the development of an optimal pre- and post-operative voice therapy intervention. In particular, these investigators stated that there is some literature suggesting the value of voice therapy to reduce the edema associated with vocal fold pathology especially in cases where lesions arise from vocal misuse. However, there is no strong evidence to support or refute this opinion which may explain the variation in pre-operative intervention. These researchers stated that there is a growing body of evidence that suggested that pre-operative voice therapy can negate surgical intervention in some cases. This now requires more robust scientific investigation to determine which aspects of voice therapy have the greatest potential to influence outcomes.

Adriaansen et al. (2022) provided an overview of the existing literature concerning the effects of voice therapy in children with VFNs in a systematic review. 24 studies were included in this systematic review. Eight studies (8/24) reported a significant improvement for at least one outcome parameter after voice therapy. However, five papers (5/24) could not demonstrate significant changes after voice therapy. All studies that did not test for significance (11/24) found improvements for one or more outcome parameters. The overall quality of the included studies is adequate (55%). In sum, there is some evidence that voice therapy is effective in children with VFNs, but further well-designed research, especially randomized controlled trials, is necessary to confirm these results.

Iqbal et al. (2022) conducted a study to determine the treatment strategies used by speech-language pathologists in pediatric vocal fold nodules using a cross-sectional. Sixty-five speech-language pathologists working with children in private clinics and

multidisciplinary settings were recruited using purposive sampling. A self-structured questionnaire was used for data collection. Analysis using SPSS -18 revealed that a combination of voice therapy and vocal hygiene was the most favored treatment used by 65 (100%) speech-language pathologists, followed by 58 (89.2%) who also favored respiratory and relaxation exercises, and 56 (86.2%) who also included parental counseling. Hence, a combination of voice therapy and vocal hygiene is a good therapeutic technique being practiced by speech pathologists for the treatment of vocal nodules among pediatric population.

White et al (2023) examined the evidence for pre- and post-operative voice therapy to inform the development of an evidence-based intervention. Electronic databases were searched using key terms including dysphonia, phono-surgery, voice therapy and outcomes. Of the 432 articles identified, 35 met the inclusion criteria and were included in the review -- 5 were RCTs, 2 were individual cohort studies, 1 was a case-control study and 26 were case-series studies. There was considerable heterogeneity in participant characteristics. Information was frequently lacking regarding the content timing and intensity of the reported voice therapy intervention, and where present, interventions were highly variable. The authors concluded that reporting in relevant literature is limited in all aspects of content, timing and intensity of intervention. These researchers stated that further intervention development work is needed to develop a robust voice therapy treatment intervention for this population, before effectiveness work can commence.

Resonant Voice Therapy

Barrichelo-Lindström and Behlau (2009) examined perceptually and acoustically Lessac's Y-Buzz and sustained productions of Brazilian Portuguese habitual /i/ vowels pre- and post-training and verified the presence of formant tuning and its association with the perception of a more resonant voice. The subjects of this study were 54 acting students (23 males and 31 females) with no voice problems, distributed in 7 groups. Each group received 4 weekly sessions of training. The authors concluded that it was not possible to establish association between the perceptual grades and measures F(1)-F(0) or F(1)-H(2). Hazlett and associates (2011) reviewed the current published available research into the impact of voice training on the vocal quality of professional voice users and provided implications for vocal health and recommendations for further research. These investigators performed a systematic search of the literature using electronic databases and the following defined search terms: occupational voice or occupational dysphonia or voice and occupational safety and health. To obtain the comprehensive relevant literature, no studies were excluded on the basis of study design. A total of 10 studies that examined the impact of a voice training intervention on the vocal quality of professional voice users as a potential prevention strategy for voice disorders were selected for this review. The 10 studies ranged in design from observational to RCTs with mainly small sample sizes (n = 11 to 60); 9 studies showed that voice training significantly ($p < 0.05$) improved at least 1 voice-related measurement from the several investigated from baseline. A total of 5 studies

reported that voice training significantly ($p < 0.05$) improved at least 1 measurement compared with no training. The authors concluded that the findings of this analysis indicated that there is no conclusive evidence that voice training improves the vocal effectiveness of professional voice users, as a result of a range of methodological limitations of the included studies. However, some studies showed that voice training significantly improved the knowledge, awareness, and quality of voice. Thus, there is a need for robust research to empirically confirm this, with implications for vocal health, and occupational safety and health policies. Yiu et al. (2017) reviewed the literature on resonant voice therapy and evaluated the level of evidence on the effectiveness of using resonant voice therapy in treating dysphonia. A total of 13 papers met the search criteria; 9 were selected by the 2 reviewers; 2 of the papers were RCTs and the other 7 were observational studies. At least 4 types of resonant voice therapies were described. They included the Lessac-Madsen resonant voice therapy, Y-Buzz, resonance therapy and humming. The overall level of quality of evidence was graded as "moderate". The authors concluded that there were limited studies that examined the effectiveness of resonant voice therapy. Most studies were small-scale uncontrolled observational studies with the inclusion of only small samples or specific populations. They stated that there is clearly a need for more large-scale RCTs with a wider range of populations to provide further evidence on the effectiveness of resonant voice training for different populations.

Saltürk et al. (2019) evaluated objective and subjective changes in the voices of adults with vocal fold nodules who received resonant voice therapy. Twenty-six female patients who had bilateral vocal fold nodules and 30 healthy women were included in the study. Patients were treated with vocal hygiene education and resonant voice therapy. Voice records were obtained for acoustic and aerodynamic analysis. Fundamental frequency, jitter, shimmer, and noise-to-harmonic ratio were analyzed for acoustic analysis. Maximum phonation time was used for aerodynamic evaluation. Voice Handicap Index 10 was completed by patients for subjective assessment. After 8 weeks of therapy analyses were repeated. Stroboscopic analysis revealed that 14 patients had total and 9 had partial regression. Fundamental frequency increased from 152.27 ± 28.34 to 199.56 ± 11.25 in study group and this was statistically significant. Jitter, shimmer, and noise-to-harmonic ratio improvements were also significant. Voice Handicap Index scores decreased from 22.25 ± 3.82 to 8.92 ± 5.48 and this was statistically significant. Authors concluded that their finding that resonant voice therapy improved objective and subjective parameters of vocal function in patients with vocal fold nodules indicates that it is an effective treatment for VFNs and should be considered a therapeutic option.

Liu et al. (2022) compared the rehabilitation outcome of two voice intervention methods for female elementary school teachers with self-reported voice disorders. A total of 34 female teachers from two primary schools volunteered in the study. Participants from one school were assigned to the experimental group (16 teachers), who received the combination of vocal hygiene education and resonant voice therapy. Participants from the

other school were assigned to the control group (18 teachers), who received vocal hygiene education only. Pre- and post-treatment data were compared. The total score of the Voice Handicap Index (VHI) decreased significantly from 12.19 ± 8.58 to 8.63 ± 7.27 ($P < 0.05$); the functional score of VHI significantly decreased from 5.38 ± 3.9 to 3.81 ± 3.62 ($P < 0.05$). No statistical significance was found in physiological and emotional scores of VHI. No statistical significance was found in the control group. In the experimental group, the maximum phonation time was increased from 14.34 ± 6.80s to 17.21 ± 6.06s ($P < 0.05$), Jitter decreased from 0.45% ± 0.13% to 0.26% ± 0.05% ($P < 0.05$), and Shimmer decreased from 0.21 ± 0.10. to 0.12 ± 0.03 ($P < 0.05$). Furthermore, the harmonic to noise ratio increased from 23.06 ± 2.99 to 25.23 ± 1.92 ($P < 0.05$), Spectrum Convergence Ratio increased from 0.53 ± 0.12 to 0.60 ± 0.11 ($P < 0.05$), yet no statistical significance was found in Nonlinear Energy Difference Ratio data for the experimental group. No statistical significance was found in the control group. In the auditory perception assessment (GRBAS), the G score decreased from 1.19 ± 0.54 to 0.81 ± 0.40 ($P < 0.05$), and the R score decreased from 1.19 ± 0.54 to 0.75 ± 0.45 ($P < 0.05$) in the experimental group. No statistical significance was found in the B, A, and S scores in the experimental group; moreover, none of the GRBAS scores in the control group demonstrated statistical significance. In the voice type component profile (VTC), the proportion of VTC1 of the experimental group increased significantly, while the proportions of VTC3 and VTC4 decreased significantly, indicating the improvement of voice quality was obvious after the intervention. The proportions of VTC of the control group did not demonstrate significant change. Authors concluded that results of this study show that a combination of vocal hygiene education and resonant voice therapy can significantly improve the voice function of professional voice users and effectively improve their voice quality. In this study, the professional voice users receiving vocal hygiene education only did not show significant improvement of their voice quality.

PRACTITIONER SCOPE AND TRAINING

Practitioners should practice only in the areas in which they are competent based on their education, training, and experience. Levels of education, experience, and proficiency may vary among individual practitioners. It is ethically and legally incumbent on a practitioner to determine where they have the knowledge and skills necessary to perform such services and whether the services are within their scope of practice.

It is best practice for the practitioner to appropriately render services to a member only if they are trained, equally skilled, and adequately competent to deliver a service compared to others trained to perform the same procedure. If the service would be most competently delivered by another health care practitioner who has more skill and training, it would be best practice to refer the member to the more expert practitioner.

Best practice can be defined as a clinical, scientific, or professional technique, method, or process that is typically evidence-based and consensus driven and is recognized by a

majority of professionals in a particular field as more effective at delivering a particular outcome than any other practice (Joint Commission International Accreditation Standards for Hospitals, 2020).

Depending on the practitioner's scope of practice, training, and experience, a member's condition and/or symptoms during examination or the course of treatment may indicate the need for referral to another practitioner or even emergency care. In such cases it is prudent for the practitioner to refer the member for appropriate co-management (e.g., to their primary care physician) or if immediate emergency care is warranted, to contact 911 as appropriate. See the *Managing Medical Emergencies (CPG 159 – S)* policy for information.

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