**INTRODUCTION**

**Definition of Voice Disorders**

A voice disorder exists when the structure and/or function of the larynx interrupts the typical process of respiration, phonation, or resonance and results in changes with loudness, pitch, or quality of the voice (Boone & McFarlane, 2000). These changes are considered problematic when they are viewed as inappropriate for an individual's age, gender, cultural background, or geographic location (Aronson & Bless, 2009). Colton & Casper (1996) proposed nine major symptoms related to voice problems: (1) hoarseness; (2) vocal fatigue; (3) breathiness; (4) reduced phonation range; (5) aphony; (6) pitch breaks; (7) strain; (8) tremor; and (9) pain with phonation. While a complete review of the components of a comprehensive voice evaluation is beyond the breadth of this paper, an accurate diagnosis is crucial for appropriate intervention. Because of the complex nature of diagnosing and treating voice disorders, a multidisciplinary team approach is highly recommended, consisting of the minimum of an otolaryngologist and SLP evaluating the patient together (Rammage, Morrison, & Nichol, 2001).

**Prevalence of Voice Disorders**

Voice disorders are relatively common in both the pediatric and adult population. Over one million children in the United States may be affected by chronic dysphonia (Gumport et al., 1998), and estimates regarding incidence of voice disorders in school-aged children range from 6–23% (Maddern et al., 1991 & Akif Kiliç, 2004). For the adult population, approximately one in every 13 adults, or 17.9 million people, will experience a voice problem annually, with more females reporting voice problems than males (Bhattacharyya, 2014). In children, aged 1–18 years of age, 59% were diagnosed with vocal fold nodules, 10.3% with vocal fold cysts, and 6.8% with acute laryngitis. In adults aged 19–60 years of age, 20.5% were diagnosed with functional dysphonia, 12.5% with vocal fold nodules, 12% with vocal polyps. In adults over the age of 60, the highest percentage (26.5%) was diagnosed with presbyphonia (Martins et al., 2015). This reinforces that the etiology of voice disorders can change with age and must be considered during both evaluation and treatment. Despite an estimated 17.9 million adults reporting voice problems, only 10% will seek treatment (Bhattacharyya, 2014).

**Underlying Principles of Voice Therapy**

Voice therapy techniques are based on a firm understanding of laryngeal anatomy and phonatory physiology in order to achieve desired outcomes (Colton & Casper, 1996). Behavioral voice treatment efficacy has been described in numerous fields, including speech-language pathology, otolaryngology, neurology, and vocal performance. As such, the goal of behavioral voice treatment is to enhance vocal efficiency in relation to the underlying voice disorder and reduce the effects of the laryngeal disorder (Ramig & Verdolini, 1998).

While pediatric voice disorders are beyond the scope of this paper, it should be noted that voice therapy techniques described in this article can be modified by using adjusted developmentally-appropriate language, child-friendly activities, incorporating the child’s caregiver into the sessions to help facilitate practice and carry-over, and additional sessions to achieve the goals of treatment (Theis, 2010). In addition, voice therapy telepractice continues to gain popularity as a treatment modality, especially during the COVID-19 pandemic. Therapy techniques described in this article can also be used through telepractice, with slight modifications implemented. That being the case, utilizing voice therapy through telemedicine has been shown to improve outcomes and has demonstrated clear advantages in meeting individual patient needs (Towey, 2013). Treatment options for voice therapy can be broadly classified into indirect or direct interventions. Indirect approaches include patient education and counseling. Patient education typically consists of discussing the anatomy and physiology of voicing and the impact of voice disorders on vocal function, including vocal hygiene. Counseling uses strategies such as stress management and addressing other psychosocial factors that might be negatively affecting voice quality (Van Stan et al., 2015). In contrast, direct approaches to voice therapy focus on modifying the physiology of the vocal mechanism by focusing on symptomatic voice therapy or physiologic voice therapy principles (Stemple, 2000), which will be discussed in further detail.

Typically, intervention involves a combination of direct and indirect therapeutic approaches to obtain optimal results and begins with addressing vocal hygiene. Vocal hygiene includes education about healthy voice care, increased hydration, and elimination of vocal misuse/phonotraumatic behaviors, such as excessive yelling or screaming. While vocal hygiene is traditionally implemented in voice care plans, it is not typically recommended as the only approach to be used.
Symptomatic Voice Therapy

The focus of symptomatic voice therapy involves the direct modification of the vocal symptoms or the perceptual voice characteristics that were identified during the voice evaluation (Stemple et al., 2020). The underlying principle is that the majority of voice disorders are due to functional misuse of the voice components, such as respiration, phonation, resonance, pitch, loudness, and rate (Boone et al., 2000). Some general vocal symptoms that can be addressed using symptomatic approach include pitch that is either too high or too low, vocal fry, voicing that is too soft or too loud, and breathiness. As summarized in Stemple et al. (2020), Table 1.

Chant Therapy: One example of a symptomatic voice therapy approach is chant therapy, which is distinguished by repeating syllables on one continuous tone, creating a type of “singing monotone.” It is characterized by pitch elevation, vowel repeating syllables on one continuous tone, creating a type of therapy approach is chant therapy, which is distinguished by the least intraglottal impact stress) (Verdolini et al., 1998). As a maximum vocal economy (i.e., the greatest vocal output with therapy program designed to help individuals produce voice with therapy programs, a thorough review of RVT is provided.

Physiologic Voice Therapy

Physiologic voice therapy techniques have been developed to modify the underlying physiology of the vocal mechanism to improve voice quality. Any type of disturbance in phonation, respiration, or resonance can lead to a disordered vocal quality. Therefore, the goal of physiologic voice therapy techniques is to balance the three subsystems (i.e., respiration, phonation, and resonance) in contrast to working directly on isolated voice symptoms. Despite the source of the voice problem, the therapeutic approach is a direct modification of the physiologic activity through exercise and manipulation (Stemple, 2000) (Fig. 1).

Physiologic voice therapy includes voice therapy programs such as vocal function exercises (VFE), Accent Method, manual laryngeal musculoskeletal tension reduction (MLMTRT), and resonant voice therapy (RVT). Because RVT is one of the most widely used voice therapy programs, a thorough review of RVT is provided.

Resonant Voice Therapy: RVT is a holistic and hierarchical voice therapy program designed to help individuals produce voice with maximum vocal economy (i.e., the greatest vocal output with the least intraglottal impact stress) (Verdolini et al., 1998). As a physiologic approach to voice therapy, RVT aims to rebalance the following subsystems of voice:

- Respiration
- Phonation
- Resonance (Stemple, 2000)

As implied by the name, RVT is based on modifying resonance to positively impact multiple physiologic levels. Specifically, patients are trained to produce voice characterized by oral vibratory sensations localized to the anterior alveolar ridge or adjacent facial plates (Chen et al., 2014; Cooper, 1973; Lessac, 1967; Verdolini-Marston, 1995). The extreme far-forward focus taught within RVT is derived from principles of a semi-occluded vocal tract (Titze, 2006). In RVT, the semi-occlusion occurs at the ends of the resonating cavities which consequently reduces unnecessary pressure at the level of the vocal folds (Roy et al., 2003). Other semi-occluded vocal tract exercises which may accompany RVT include the following:

- Kazoo, straw, and tube phonation
- Humming
- Tongue and lip trills

Ultimately, RVT highlights and improves the interactive relationship between the voice source (i.e., vocal folds) and filter (i.e., pharyngeal, oral, and nasal cavities) to reduce the risk of or mitigate vocal fold injury.

Who Receives Resonant Voice Therapy?

Studies involving laryngeal imaging show a resonant voice is produced with the vocal folds in a barely abducted/barely adducted configuration (Verdolini et al., 1998). Training this type of configuration contributes positively to individuals who demonstrate both hyperfunctional voice disorders, where the goal is decreased vocal fold adduction, and hypofunctional voice disorders, where the goal is increased vocal fold adduction. However, comprehensive laryngeal visualization is required prior to utilizing this approach. Ideally, a speech-language pathologist (SLP) and otolaryngologist will participate in a collaborative examination to evaluate the health of the laryngeal mechanism. During this time,

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both professionals will guide the patient through stimuliability trials consisting of RVT principles to determine the appropriateness of the approach as related to the patient’s clinical history, perceptual vocal quality, and visualization findings. Previous studies have supported the use of RVT in the management of the following:

- Vocal fold nodules (Chen et al., 2007; Saltürk et al., 2018)\(^{23,38}\)
- Vocal fold inflammation (Verdolini Abbott et al., 2012)\(^{24}\)
- Vocal fold paralysis (Kao et al., 2017; Schindler et al., 2008)\(^{25,26}\)
- Muscle tension dysphonia (Chen et al., 2007; Watts et al., 2019)\(^{21,27}\)
- Occupational voice users (Liu et al., 2020; Roy et al., 2003)\(^{36,22}\)

**Resonant Voice Therapy Hierarchy**

RVT utilizes segmentation to divide a kinesthetically complex behavior into well-defined targets. A typical therapeutic hierarchy is described below.

- **Basic Training Gesture**
  - At the start of RVT, clinicians will teach patients a basic training gesture (BTG). The BTG may consist of a vocal sigh from high to low pitch during multiple repetitions of /molm/ or repetitions of elongated consonant sounds such as /m/ or /n/. (Stemple et al., 2020; Verdolini-Abbott, 2008).\(^{14,28}\) The goal of this exercise is to teach patients to localize oral-vibratory sensations near the front of the face while demonstrating balanced phonatory airflow. Ultimately, the BTG provides the foundation for easy and healthy phonation.

- **Vowels**
  - Following training of the BTG, patients are encouraged to produce elongated consonant sounds with accompanying vowels (e.g., /ma/, /me/, /mo/, etc.). Patients may chant these productions on a singular musical note and/or with varying intonation patterns found in conversational speech. During this stage, all target productions contain voiced sounds which eliminates the added complexity associated with laryngeal articulation and allows patients to build sensory awareness related to how a resonant voice feels and sounds. Stemple et al. (2020) recommend varying rate, pitch, and loudness factors to mimic the variability present within everyday speech.\(^{14}\)

- **Words, Phrases, and Sentences**
  - At this time, target productions of increasing complexity contain voiced and voiceless contrasts to reflect the rapid laryngeal articulation characteristic of conversational voice production (e.g., “maybe,” “maybe tomorrow,” and “maybe I’ll meet you tomorrow”). Clinicians will often encourage patients to employ the BTG with a meaningful phrase to improve the functionality of therapy stimuli (e.g., “Tell me something you say frequently at work.”). Additionally, patients will benefit from learning and practicing reset words during this stage (Schneider, 2018).\(^{39}\) Reset words include utterances such as “yeah,” “okay,” and “um” that are produced naturally with the accompanying BTG (e.g., “hmm + yeah”). Reset words enable patients to retune their resonant voice when they notice themselves reverting to habitual voicing patterns.

- **Question and Answer**
  - The ultimate goal of voice therapy is to train healthy voicing patterns that allow patients to meet functional voice demands. Given that everyday voice demands consist of conversational speech contexts, voice therapy should attempt to transition techniques to functional settings as soon as possible. One way to do this is by asking simple questions such as, “What did you have for breakfast?” Simple and concrete questions allow patients who are in the early stages of resonant voice generalization to sustain attention to their resonant voice while providing a response. As patients become increasingly comfortable with RVT, questions such as, “What did you do last weekend?” or “What is something you’re looking forward to?” may be used to increase the cognitive demands associated with back-and-forth dialogue.

**Conversational Speech**

- Following basic question and answer trials, therapy shifts to the most natural context: Conversation. Initially, resonant voice at the conversational level is taught by encouraging patients to include the BTG prior to the onset of each phrase or sentence. The BTG is faded once patients demonstrate continuous forward resonance and report easy phonation. As outlined in Stemple et al. (2020), environmental and emotional manipulations are important to include given the diverse settings and topics patients will participate in outside of the treatment room.\(^{14}\) Examples of environmental and emotional manipulations include:
  - Role-playing occupational voice use (e.g., lectures, scripts, closing arguments)
  - Practicing RVT in a noisy environment (e.g., cafeteria or coffee shop with background music)
  - Eliciting conversations that prompt laughter, anger, and/or sadness with accompanying loudness variations

**Clinical Problem Solving and RVT**

Patients will respond to RVT in various ways. The following paragraphs include brief descriptions of common challenges specific to RVT and corresponding ways to troubleshoot.

- **Difficulty perceiving oral-vibratory sensations**
  - When patients are first asked, “Where do you feel your voice?”, a common response is, “I’ve never thought about that before.” Consequently, immediately presenting patients with information related to resonance modification may be met with confusion, frustration, and reduced self-efficacy. To reduce or prevent these emotions, Schneider (2018) supports the use of SOVT exercises such as lip trills and straw phonation to magnify oral vibratory sensations.\(^{39}\) The improved localization of voice by means of SOVT exercises contributes to the foundation of forward focus that is central to RVT. If ongoing perceptual difficulty occurs, clinicians may encourage patients to do the following:
    - **Place a finger under the nose or place a hand in front of the mouth:** This gesture allows patients to monitor continuous airflow during resonant voice production. Lack of continuous airflow, even at the end of phrases, will negatively impact a patient’s ability to sustain and perceive a resonant voice.
    - **Cup hands around the nose:** This maneuver creates a resonance chamber to amplify vibrations of consonant sounds produced near the front of the face. The amplification provides increased auditory feedback to help patients improve awareness of where their voice is produced.

- **Vary the elongated consonants:** Patients may benefit from sustaining consonant sounds /mi, /ni, /ngi, /s/, /z/, /l/, /nl, /sh/, and /dg/ (Schneider, 2018). Clinicians are
encouraged to determine which sound(s) the patient is most stimulable to (i.e., which sounds produce the greatest change in voice quality), and then use these sounds throughout increasing levels of complexity (e.g., “/ng/ → go,” “/ng/ → go get,” and “/ng/ → go get me gum”).

• **Difficulty generalizing to conversation**

• **Conversation Training Therapy:** Transferring healthy voice patterns to conversation has been regarded as the most difficult part of voice therapy (Grillo, 2012; Iwarsson, 2015; Iwarsson et al., 2017). To address this concern, Gartner-Schmidt et al. (2016) developed conversation training therapy (CTT), which is a novel voice therapy program that employs patient-driven conversation as the sole therapeutic stimuli. Unlike RVT, CTT is not hierarchical in nature; however, both RVT and CTT utilize a BTG, specifically elongated consonants, to target vibrations near the front of the face. Additionally, a key component of CTT is asking patients to demonstrate “clear speech” which is suspected to also promote increased awareness of oral resonance. While a complete review of CTT is not within this scope of this article, readers are encouraged to review work by Gartner-Schmidt et al. (2021) and Gillespie et al. (2019) for additional information and recommendations of how to implement CTT in daily practice.

• **Negative Practice:** Negative practice contributes positively to behavioral learning and habit change in the realm of voice therapy (Iwarsson, 2015). In negative practice, patients are asked to alternate between the habitual “old” voice and the target “new” voice. Discrimination between “old” and “new” voices allows patients to discover an internal sense of control and empowerment related to their vocal quality (Helou, 2017). Although negative practice is listed as a way to improve generalization to conversation, this technique may be used early on in the therapeutic hierarchy to motivate practice and at the conversational level for resonant voice stabilization.

**Summary of RVT**

RVT is a physiologic voice therapy program aimed to help patients produce their best voice with the least amount of effort. The barely abducted/barely adducted laryngeal configuration specific to resonant voice production maximizes health of the laryngeal mechanism and is appropriate to use in the context of several voice disorders. Other fundamental characteristics of RVT include experiential sensory processing and numerous repetitions of training stimuli at increasing levels of complexity.

**Conclusion**

In conclusion, voice therapy techniques have been shown to be effective in modifying vocal quality in a variety of voice disorders by having a thorough understanding of the relationship of the vocal pathology and the relationship of respiration, phonation, and resonance. When implementing therapeutic approaches, we must always consider the whole person when viewing a voice disorder (Stemple, 2000) and utilize approaches that best serve the needs of the individual patient. While the goal of this paper is to provide a brief tutorial regarding voice therapy principles and techniques, please note that this is not intended to be a substitute for additional training, education, and mentorship with techniques prior to using with patient populations. In some cases, a combination of surgical, medical (pharmacological), and behavioral voice treatment is indicated; therefore, a multidisciplinary team approach is always recommended.

**References**

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