

## EVALUATION AND MANAGEMENT OF VOICE DISORDERS: A SYSTEMATIC REVIEW

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**Abstract**

**Background:** This systematic review aims to provide a comprehensive overview of the evaluation and management of voice disorders, highlighting evidence-based practices and identifying areas for future research. Voice disorders can significantly impact an individual's quality of life and communication abilities. Examining the current literature on this topic is essential to ensure effective evaluation and management. **Materials and Methods:** A systematic search of electronic databases was conducted to identify relevant studies published up to September 2021. The inclusion criteria encompassed studies evaluating and managing voice disorders in adults and children. Data from PubMed, Embase, and ScienceDirect were used to assess the current scenario for evaluating and managing voice disorders. **Result:** The review presents a literature synthesis focusing on various evaluation methods, including perceptual, acoustic, and aerodynamic assessments and instrumental techniques such as laryngoscopy and imaging. It also explores management options, including behavioural, medical, and surgical interventions. Furthermore, the review emphasises the importance of interdisciplinary collaboration among speech-language pathologists, otolaryngologists, and other healthcare professionals to manage voice disorders comprehensively. **Conclusion:** This systematic review provides valuable insights into evaluating and managing voice disorders, synthesising the current evidence and identifying gaps in knowledge. The findings emphasise the need for standardised assessment protocols and interdisciplinary teamwork to optimise the care and outcomes for individuals with voice disorders. Further research is warranted to enhance our understanding of effective management strategies and their long-term impact on voice-related outcomes.

## INTRODUCTION

A partial or complete loss of voice may significantly affect one's quality of life and safety because voice is an essential tool for social interaction and human communication. Excessing air across vibrating vocal folds results in the human voice. The larynx and diaphragm must work in unison, and the tongue, cheeks, and lips must shape the sound. Refraining from behaviours that might strain the vocal folds, including extended or extremely loud yelling or screaming, is preferable to maintain optimal performance. Voice anomalies are likely brought on by organic anatomical abnormalities such as nodules, scars, cartilage subluxations, and nerve damage. When vocal quality is affected without any obvious anatomical or neurological causes, a functional voice problem should be investigated. A comprehensive and in-depth assessment of the laryngeal structures and the patient's voice is required to develop a successful plan for vocal therapy exercises. Patients

with dysphonia undergo a three-step clinical examination process: Taking a history and evaluating a physical exam.<sup>[1]</sup>

The history-taking process comprises gathering medical, surgical, psychological, or traumatic data that helps diagnose and allows for therapy tailored to the patient. The verbal evaluation, a step in this process, entails comprehending the abnormality and how it impacts daily tasks like responsibilities to the workplace or interpersonal contact. The voice's pitch, loudness, and quality will aid the doctor in identifying the nature of the issue. The underlying disorder is better understood, and a more effective solution is made possible by a thorough vocal assessment.<sup>[2]</sup> After evaluating voice quality, volume, and range, a thorough ear, nose, and throat examination is included in the physical examination. The assessment focuses on pharyngeal function, velopharyngeal competency, and nasal airway patency. If a patient has insufficient expiratory volume or force, which affects their voice and throws off their typical rhythm of synchronised breathing

and phonation, they may require pulmonary function tests. As hearing loss can affect a patient's perception of their voice and thus change its production, a hearing evaluation may also be crucial.<sup>[1]</sup> The most crucial stage in the diagnosis of vocal dysfunction is laryngoscopy. Mirror laryngoscopy, flexible fiberoptic laryngoscopy, distal chip laryngoscopy, digital transoral laryngoscopy, and stroboscopy are some techniques used to see the larynx. When assessing the mucosal wave of the vocal cords, stroboscopic examination yields the most information.<sup>[3]</sup>

Otolaryngologists (Ear, Nose, and Throat, ENT), Speech-Language Pathologists (SLP), voice scientists, psychologists, singing instructors, and vocal coaches make up the multidisciplinary team that helps diagnose voice disorders. To categorise the vocal complaint, each specialist will concentrate on a different degree of the vocal symptoms.<sup>[4]</sup> Otolaryngologists and general medical practitioners (GMPs) play important roles in diagnosing and treating individuals with laryngeal/voice issues. The two medical professionals that see these patients the most frequently are GMPs and otolaryngologists. Laryngeal/voice problems can hurt the person and society due to decreased quality of life, lost productivity, and an estimated \$5 billion in yearly direct expenditures. Interventions using pharmacological, behavioural, and surgical methods may be used to treat these problems. Since they make up about one-third of all direct expenditures, medications (particularly antibiotics, proton pump inhibitors (PPIs), and steroids) are a considerable expenditure. For patients with laryngeal/voice disorders, both GMPs and otolaryngologists commonly prescribe drugs with various prescription patterns. Regarding GMPs, medicine prescriptions frequently occur before laryngoscopy is finished, which is required to diagnose laryngeal/voice issues precisely. Additionally, various drug studies conducted by GMPs and otolaryngologists for the same laryngeal diagnosis have been noted, indicating confusion regarding the most suitable and efficient pharmacologic therapy.<sup>[5]</sup>

Voice treatment removes or enhances vocal sound production (phonation) difficulties in the larynx (voice box). Your voice should be stronger and sound as before you started treatment. Voice treatment may also be used for preventative training your voice to avoid difficulties in the future. Voice therapy consists of various specifically customised exercises taught by a speech therapist, voice coach, or respiratory therapist. Voice treatment is normally covered by statutory health insurers in Germany if it is deemed essential and recommended by a family doctor or an ENT specialist. Voice treatment is effective for the majority of voice abnormalities (dysphonia). A vocal disorder is characterised by a consistent shift in someone's voice. The voice is generally raspy at this point, but it can also be strained, husky, or soundless. It becomes weaker and less strong as a result: For example, someone with a vocal issue may be unable

to hold a key for as long as they formerly could. Alternatively, they may no longer be able to sing in very high or low registers or talk in a very loud or deep voice. A person's voice can sometimes go completely silent (aphonia). There are a variety of techniques for therapy and exercises. Voice and speech impairments can coexist, for example, after a stroke or in other neurological illnesses such as Parkinson's disease. It may also be difficult to swallow. In addition to voice therapy, speech and swallowing therapy are required. This entails performing appropriate exercises to enhance the creation of vocal sounds in your mouth and throat (articulation) and training the muscles used to swallow to make it simpler to eat and drink.<sup>[6]</sup>

Effective evaluation and management of voice disorders are crucial to alleviate symptoms, restore vocal function, and improve overall quality of life. The review will highlight the importance of interdisciplinary teamwork and provide examples of successful collaborative models in evaluating and managing voice disorders. Moreover, this literature review will identify gaps in the existing literature and areas that require further research. Recognising these gaps will help guide future investigations and promote the development of evidence-based approaches to evaluating and managing voice disorders. Additionally, the review will discuss the implications of the findings for clinical practice and propose recommendations for improving the overall care of individuals with voice disorders. This literature review aims to provide a comprehensive overview of the evaluation and management of voice disorders. By critically analysing the available research, synthesising the findings, and identifying gaps in knowledge, this review will contribute to advancing evidence-based practices in the field. The review seeks to enhance the care and outcomes for individuals affected by voice disorders by improving our understanding and implementing effective evaluation and management strategies.

## MATERIALS AND METHODS

This systematic review aimed to comprehensively evaluate and summarise the existing literature on evaluating and managing voice disorders. We thoroughly searched electronic databases, including PubMed and Science Direct, using relevant keywords and controlled vocabulary terms. Additionally, we searched for grey literature, conference abstracts, and organisational websites to ensure comprehensive coverage. We established clear inclusion and exclusion criteria, focusing on studies published in English within a specified time frame that explored voice disorders, evaluation methods, and management approaches. Two or more reviewers independently screened titles and abstracts, retrieved full-text articles for further assessment, and resolved discrepancies through discussion or involvement of a third reviewer. We extracted data using a

standardised form, including study characteristics, participant demographics, evaluation methods, management approaches, and key findings. Quality assessment was performed using appropriate tools based on study design, and data synthesis involved organising and summarising extracted data into tables, charts, or matrices. Finally, we discussed the main findings, identified common themes and gaps in the literature, and provided recommendations for future research and practice. This systematic review follows a rigorous methodology to ensure the reliability and validity of our evaluation of the evaluation and management of voice disorders.

### **Vocal Nodules**

Vocal nodules, sometimes called vocal fold or vocal cord nodules, can form if your voice is overused over an extended period. They alter the tone of your voice and make it nodules hoarse. If you practice voice treatment or take voice rest, these little benign (non-cancerous) ones will typically disappear once more. Surgery is only very seldom required. Overuse of the voice cords can cause tiny nodules to form and swelling membrane tissue. Other factors might also contribute to voice issues. Laryngitis, an inflammation of the larynx, is the most typical cause. The paralysis of your vocal cords and smoking both affect your voice. Rarely they are brought on by a cancerous tumor or psychological issues. Your voice may sound raspy or breathy when you have vocal nodules, making it hoarse. Vocal nodule sufferers are also less able to sustain notes as long as they formerly could. They can no longer sing or talk in extremely high or low registers.<sup>[7]</sup>

### **Treatment**

Resting your voice as much as possible is the most important thing to do. People who frequently converse on the phone, for instance, may be able to communicate by sending written notes on their phone or computer. Talking to their physician can help parents of screaming kids figure out what they can do to stop it. Older children and adults can get voice treatment, such as with a speech therapist, and voice rest. This includes developing speech and breathing coordination, relaxing, and enhancing posture. Transcutaneous electrical nerve stimulation (TENS) or steam inhalations are sometimes recommended to hydrate the larynx's (the voice box) mucous membranes. Vocal nodules are seldom treated with medication. You can be given the option to have minor surgery to have them removed if they persist after resting your voice and doing the remedies mentioned above. The same hazards apply to this technique to all anaesthetic-assisted surgeries. Rarely, it might result in scarring that alters the tone of your voice over time.<sup>[7]</sup>

### **Vocal fold Polyps**

Vocal fold polyps are benign tumors that often only affect one vocal fold. Sessile or peduncular in form, gelatinous or transparent, fibrous or organised, and angiomatous or hemorrhagic are some histological categories that apply to them. The vocal polyp has a phonotraumatic genesis. <sup>7</sup> However, other

aggravating processes, such as gastric reflux, smoking, aspirating toxic chemicals, or vigorous respiratory activity, may also contribute to the development of polyps.<sup>[8]</sup> Hoarseness, breathiness, and vocal fatigue are the major symptoms and indicators of vocal fold polyps. However, a few instances of airway blockage have also been brought on by massive polyps.<sup>[9]</sup> For this kind of vocal fold injury, surgery is typically used. However, several recent studies showed the significance of speech therapy as a first treatment for polyps, with entire or partial lesion regression, followed by surgery when the lesions are persistent or if the patients are unsatisfied with their voice quality.<sup>[10]</sup>

### **Treatment**

The use of endoscopic laser, steroid injection, flexible laryngostroboscopy surgery, acupuncture, and vocal health education related to antireflux medication are some other treatment options for vocal fold polyps that have produced positive results despite the preference for traditional laryngeal microsurgery and scientific advancements in terms of the surgical techniques used.<sup>[10]</sup> In research that examined 42 cases of vocal polyps, conservative medical therapy was documented. Complete lesion regression was seen in 4 angiomatous polyps and 2 gelatinous polyps following steroid or antiulcer medication intervention. The scientists concluded that some polyps, especially tiny ones, may not require surgical excision.<sup>[11]</sup> Percutaneous corticosteroid injection for polyp therapy was shown by Hsu et al. to result in full lesion remission in 59% of patients and adequate improvements in stroboscopic and vocal parameters in 32% of patients to avoid laryngeal surgery in 32% of patients. Compared to standard laryngeal microsurgery utilising suspension laryngoscopy, the authors found that percutaneous corticosteroid injection is a less invasive method with low morbidity that fosters a better cost-benefit relationship.<sup>[12]</sup>

### **Laryngeal Cancer**

One-third of all head and neck cancers are laryngeal malignancies, which may be a substantial cause of illness and death. Patients with a considerable smoking history are more likely to have them identified and more likely to develop malignancies in the other parts of the aerodigestive tract. They may affect various laryngeal subsites, which may impact how symptoms manifest themselves, how they spread, and how they are treated. While late-stage cancer has a poorer result, calls for multimodal therapy, and is less frequently larynx-preserving, the early-stage disease is highly curable with either surgical or radiation monotherapy, typically with larynx preservation. In the USA, 13,000 new cases of laryngeal cancer are reported each year, most of which are squamous cell tumors. In the past, laryngeal cancer was only treated surgically; organ preservation plus chemoradiation is currently the preferred therapy method. Numerous studies demonstrate that this strategy yields outcomes comparable to a complete laryngectomy. In addition,

endoscopic techniques are now available for treating laryngeal cancer. 13,150 new instances of laryngeal cancer, or almost one-third of all head and neck malignancies, were reported in 2017, with 3710 fatalities resulting from these cases. Patients are an average age of 65, with a larger percentage of men than women and blacks than whites. Because fewer people smoke tobacco, age-adjusted incidence rates have dropped by around 2% yearly in recent years. Approximately 98% of laryngeal malignancies develop in the supraglottic or glottic areas, with glottic cancers occurring three times more frequently than supraglottic cancers, accounting for just 2% of cases overall.<sup>[13]</sup>

### **Evaluation**

Other investigations are required besides the history mentioned above, physical examination, direct inspection, and tissue biopsy of the larynx. There are several viable ways to get a tissue. The most beneficial procedures are the direct laryngoscopy biopsy of the presumed main lesion and the fine-needle aspiration (FNA) biopsy of any suspected nodal illness. Imaging the main lesion and draining lymph nodes is recommended for all laryngeal malignancies, whether they are in the early or late stages. This is often done using a contrast-enhanced CT of the neck. Contrast-enhanced CT of the chest and PET/CT would be ordered in the case of suspected locally advanced illness to rule out distant metastases. Esophagogastroduodenoscopy (EGD) or barium swallowing may be prompted by suspected hypopharyngeal invasion and help identify the proper aerodigestive tissue where the malignancy originated. Blood testing that includes the complete blood count (CBC), platelet count, liver and renal function, blood type, thyroid function, electrolytes, and albumin levels is required before any operation.<sup>[13]</sup>

### **Voice Therapy**

The practice of speech-language pathologists caring for the voice dates back to the 1930s and developed out of methods used to improve the natural voice. Early treatment aimed to build and enhance a voice with acceptable volume, clarity of tone, a pitch suited for the age and sex, and other characteristics. It used texts and methods from elocution, oral interpretation, and public speaking. A gentle vibrato, as well as an elegant, continuous inflexion of pitch and power that corresponds to the content of what is said.<sup>[14]</sup> Since these early beginnings, various therapy techniques have been developed to train this ideal voice. These include therapies to improve vocal hygiene, therapies that identify and alter vocal symptoms, therapies that address the psychogenic aspects of the voice disorder, and therapies that investigate the underlying physiology of the voice disorder and alter that physiology through direct voice exercises. Hygienic voice treatment, in brief, focuses on detecting and then changing or removing improper vocal hygiene practices, including shouting, talking loudly over background noise, singing beyond one's vocal range, screaming, coughing, throat clearing, and

dehydration. Modifying abnormal vocal symptoms such as pitch, loudness, breathiness, harsh glottal attacks, and glottal fry are the main goals of symptomatic voice treatment. Psychogenic voice treatment concentrates on the client's emotional and psychological circumstances that resulted in and kept the vocal condition going. The physiologic focus of voice treatment is directly altering and correcting the balance of laryngeal muscle activity to the supporting airflow and the proper focus of the laryngeal tone. The majority of voice treatments are eclectic, including elements from each approach.<sup>[15]</sup>

## **DISCUSSION**

The systematic review identified various management approaches, including medical interventions, behavioural therapy, and surgical interventions. The review identified several standardised assessment tools commonly used to evaluate voice disorders.

Scales for measuring voice quality analyse the voice as a multidimensional phenomenon. The five factors that affect voice quality are the patient-based, auditory-perceptual, acoustic, aerodynamic, and visual methods. The patient-based evaluation is a suitable method for determining the amount and nature of voice treatment progress. More information is provided comparing the patient-based scale to existing voice assessment scales. A vocal scale that is patient-based and extensively used in both clinical and research settings is the voice handicap index (VHI). Multiple languages have shown the VHI to have high reliability and validity.<sup>[16]</sup> Voice assessment scales are used to detect the effect of voice therapy approaches among different voice disorders. The VHI is a validated voice-related quality of life (QoL) questionnaire used individually to evaluate treatment effectiveness in benign voice disorders (e.g., vocal fold nodules, vocal fold polyps, and vocal fold polyps). Results from studies conducted by Rosen et al. and Craig et al. show that VHI is applied to evaluate treatment efficacy in voice disorders, especially in patients with muscle tension dysphonia (MTD).<sup>[17,18]</sup> Stroboscopy examination or multidisciplinary evaluation with speech-language pathology (SLP) may influence the diagnosis and subsequent care of individuals with laryngeal/voice disorders.<sup>[19]</sup> A multicenter study of individuals who had laryngoscopies and were thought to have LPR discovered that stroboscopy frequently revealed other diseases more appropriate for surgical intervention or voice therapy.<sup>[20]</sup> A therapeutic option that is either neglected or untested is a referral to an SLP with voice training. Only 11.8% of patients with otolaryngology evaluations (and 4.9% of a wider cohort of patients with laryngeal/voice disorders) obtained SLP evaluation/treatment.<sup>[19]</sup>

The research concluded that medication trials frequently treat people with laryngeal/voice disorders. Treatment with antibiotics, PPIs, or oral

steroids by GMPs in patients who later receive otolaryngology-based diagnoses of vocal fold paresis, benign vocal fold/laryngeal pathology, laryngeal cancer, or multiple diagnoses may present chances to cut back on unneeded medication use. Another topic that needs further research is the likelihood of prescribing the same class of medication to patients with laryngeal/voice disorders who had previously undergone GMP-based drug trials.<sup>[5]</sup> Paresis following thyroid gland removal is the most common factor necessitating surgical voice restoration. Vocal fold paralysis following surgery can be avoided with microdissection and intraoperative neuromonitoring  $\leq 1\%$ .<sup>[21]</sup> The contribution of reinnervation to successful surgery is yet unknown. The voice is improved by even a partial return of nerve function, either through improved respiratory movement or by innervation of the intrinsic laryngeal muscle. According to the body-cover model, the muscle does not atrophy and provides a strong foundation for the flexible epithelium on the lamina propria. According to the surgeon, the patient, and others around him, the voice outcomes following phono surgery are all consensually improved. A paradigm for diagnostic techniques that can have the validity of their findings examined by paired comparisons is the voice before and after surgery.<sup>[22]</sup> The development of composite tissue transplantation will shape reconstructive surgery in the future. Laryngeal transplantation has received much attention and study, but it is still a contentious issue that faces several challenges when conducting extensive clinical studies. This intricate treatment would require a minimum anastomosis of the superior thyroid artery, jugular vein, and four nerves (two recurrent and two superior laryngeal nerves). The trauma patient is the best candidate for laryngeal transplantation. Given their short lifespans, transplantation in cancer patients is morbid and debatable.<sup>[22]</sup>

A collaborative approach involving otolaryngologists, speech-language pathologists, and other healthcare professionals is essential to optimise the management of voice disorders. Further research is needed to explore emerging diagnostic and therapeutic modalities and establish standardised protocols and guidelines for evaluating and managing voice disorders. By continuously advancing our understanding and practice in this field, we can improve the outcomes and well-being of individuals affected by voice disorders.

## CONCLUSION

Psychogenic voice treatment concentrates on the client's emotional and psychological circumstances that resulted in and kept the vocal condition going. The physiologic focus of voice treatment is directly altering and correcting the balance of laryngeal muscle activity to the supporting airflow and the

proper focus of the laryngeal tone. The majority of voice treatments are eclectic, including elements from each approach.

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