

[Back](#) 25 page(s) will be printed.

---

**Record: 1**

**Title:** Treatment efficacy: Voice disorders.

**Authors:** Ramig, Lorraine Olson  
Verdolini, Katherine

**Source:** Journal of Speech, Language & Hearing Research; Feb98, Vol. 41 Issue 1, pS101, 16p

**Document Type:** Article

**Subject Terms:** VOICE disorders -- Treatment

**Abstract:** Addresses the efficacy of treatment for voice disorders. Definition of voice disorders; Causes of voice disorders; Effect of voice disorder on the individual and family in terms of daily-life activities; Role of the speech-language pathologist in managing individuals with voice disorders.

**Full Text Word Count:** 13323

**ISSN:** 1092-4388

**Accession Number:** 247155

**Database:** Communication & Mass Media Complete

---

**Section:** Supplement on Treatment Efficacy: Part II

## TREATMENT EFFICACY: VOICE DISORDERS

This article reviews the literature on the efficacy of treatment for voice disorders primarily using studies published in peer-reviewed journals. Voice disorders are defined, their frequency of occurrence across the life span is reported, and their impact on the lives of individuals with voice disorders is documented. The goal of voice treatment is to maximize vocal effectiveness given the existing disorder and to reduce the handicapping effect of the voice problem. Voice treatment may be (a) the preferred treatment to resolve the voice disorder when medical (surgical or pharmacological) treatments are not indicated; (b) the initial treatment in cases where medical treatment appears indicated; it may obviate the need for medical treatment; (c) completed before and after surgical treatment to maximize long-term post-surgical voice; and (d) a preventative treatment to preserve vocal health. Experimental and clinical data are reviewed that support these roles applied to various disorder types: (a) vocal misuse, hyperfunction and muscular imbalance (frequently resulting in edema, vocal nodules, polyps or contact ulcers); (b) medical or physical conditions (e.g., laryngeal nerve trauma, Parkinson disease); and (c) psychogenic disorders (e.g., conversion reactions, personality disorders). Directions for future research are suggested which maximize clinical outcomes and scientific rigor to enhance knowledge on the efficacy of voice treatment.

**KEY WORDS:** voice treatment, efficacy of voice treatment

There is both scientific and clinical evidence that individuals with voice disorders benefit from the services of speech-language pathologists. This evidence is documented in experimental research, retrospective analyses, case studies, and program evaluation data.

Treatment efficacy is a broad term that can address several questions related to treatment effectiveness (does treatment work?), treatment efficiency (does one treatment work better than another?), and treatment effects (in what ways does treatment alter behavior?) (Olswang, 1990). Treatment efficacy studies have used either group or single-subject experimental designs to answer these questions; the current review will include both methodologies.

Also included in this review are findings from retrospective analyses, case studies, and program evaluation data because they lend support to experimental findings of treatment efficacy. Although program evaluation data cannot answer questions about causal relationships between the process and outcome of treatment (often defined by functional outcomes), they can document trends in treatment for large populations. Case studies offer individual accounts of treatment benefits.

## Definition of Voice Disorders

Voice disorders are generally characterized by an abnormal pitch, loudness, and/or vocal quality resulting from disordered laryngeal, respiratory, and/or vocal tract functioning. Voice disorders range from a mild hoarseness to complete voice loss and may limit the intelligibility or effectiveness of oral communication. Voice disorders may be due to habits of vocal misuse and hyperfunction (e.g., improper use of the larynx, such as excessive throat clearing, yelling, prolonged talking over loud background noise, muscular imbalances) commonly producing physical changes in the vocal folds, other medical/physical conditions (e.g., trauma, neurological disorders, allergies) or psychological factors (e.g., stress, conversion reactions, personality disorders). It is not uncommon for a voice disorder to reflect a combination of these factors.

## Frequency of Occurrence of Voice Disorders

Voice disorders can affect individuals across the entire life span--from infancy to old age. The reported frequency of occurrence of voice disorders in schoolage children ranges from 3-6% (Hull, Mielke, Willeford, & Timmons, 1976; Senturia & Wilson, 1968) to 23.4% (Silverman & Zimmer, 1975), based on sample sizes ranging from 162 (Silverman & Zimmer, 1975) to 32,500 (Senturia & Wilson, 1968). Additional reports (e.g., Yairi, Currin, Bulian, & Yairi, 1974; Pannbacker, 1975; Cook, Palaski, & Hanson, 1979; Leeper, Leonard, & Iverson, 1980) are consistent with these data and have been summarized by Wilson (1987).

Fewer studies exist on the frequency of occurrence of voice disorders in adults; however, it has been estimated that 3% to 9% of the total population in the United States has a voice disorder (Leske, 1981; Wilson, 1972). Based on a sample size of 428 individuals, ranging in age from 18 to 82 years, Laguaitte (1972) reported that 7.2% of the males and 5% of the females had a voice disorder. It has been reported that from 12% (Shindo & Hanson, 1990) to 35% (Ward, Colton, McCannell, Malmgren, Kashima, & Woodson, 1989) of elderly individuals have disordered vocal function.

Of the total working population in the United States, 24.49% (or 28,269,000 individuals) have jobs that critically require voice use; 3.29% of the population (or 3,840,000 individuals) have occupations (e.g., air traffic controller, police, pilot) in which their voice is necessary for public safety (National Center for Voice and Speech, 1993). It is apparent that the frequency of occurrence of voice problems is "potentially one of great magnitude from a health, as well as an economic, standpoint" (Laguaitte, 1972, p. 151).

Data on the frequency of occurrence of various types of voice disorders are primarily available from retrospective reviews of clinical cases (Brodnitz, 1971; Cooper, 1973; Herrington-Hall, Lee, Stemple, Niemi, & McHone, 1988). For example, Brodnitz (1971) reported that of the 1,851 cases in his otolaryngologic practice, 25.8% had hyperfunctional voice disorders, with reddening or thickening of the cords; 19.7% had polyps; 15.3% had vocal nodules, 9.4% had polypoid thickening; 5.3% had contact ulcers; 4.7% had mutational voice disorders; 4.7% had spasmodic dysphonia; and 4.4% had psychogenic dysphonia. Cooper (1973) reported that of the 1,406 children and adults that he treated in his speech treatment practice, 36.6% had disorders of vocal abuse (including hyperfunction), 18.1% had vocal nodules, 6.1% had contact ulcers, 4.8% had polyps, 4.5% had polypoid degeneration, 4.2% had dysphonia associated with neurological disease, and 3.0% had spasmodic dysphonia. In another report, Herrington-Hall et al. (1988) reviewed 1,262 cases from otolaryngologic practices and reported that 21.6% had vocal nodules, 14.1% had edema, 11.4% had polyps, 8.1% had vocal fold paralysis, and 7.9% had functional disorders.

Voice disorders also commonly occur in individuals with neurological disorders such as Parkinson disease, stroke, closed head injury, amyotrophic lateral sclerosis (Lou Gehrig's disease), cerebral palsy, and multiple sclerosis (Aronson, 1990; Ramig & Scherer, 1992; Smith & Ramig, 1995; Ramig, 1995; Ramig, 1996). For example, 89% of the 200 individuals with Parkinson disease studied by Logemann, Fisher, Bashes, and Blonsky (1978) had disordered voices. Disordered voice was observed in 97% of 30 individuals with

pseudobulbar palsy (secondary to bilateral stroke) (Darley, Aronson, & Brown (1969a, b), 90% of 30 individuals with amyotrophic lateral sclerosis (Aronson, Brown, Litin, & Pearson, 1968) and 91% of 23 individuals with severe multiple sclerosis (Fitzgerald, Murdoch, & Cherney, 1987). Kaufman and Isaacson (1991) reviewed a series of 100 consecutive individuals seen in a practice with voice complaints. Sixteen had neurological disorders of the voice, 8 with vocal fold paralysis, and 8 with a variety of other neurological diseases including Parkinson disease, vocal tremor, and myasthenia gravis.

Vocal complaints are not uncommon in the performer who relies on the voice for his/her livelihood. Twenty-one percent of 125 singing teachers reported current vocal problems, and 64% reported past vocal problems in a recent study by Miller and Verdolini (1995). In another study of 92 choral singers, 35% of classical singers and 50% of gospel singers reported hoarseness (White & Verdolini, unpublished data).

### **Effects of the Voice Disorder on the Individual and Family in Terms of Daily-Life Activities**

In addition to being the source of sound energy for the generation of intelligible oral communication, the voice reflects emotional and personality characteristics of the speaker (Aronson, 1990; Friedhoff, Alpert, & Kurtzberg, 1962; Perkins, 1983). It is not surprising, therefore, that voice disorders can have devastating effects on individuals of all ages.

The World Health Organization (1987) offers the classifications of "impairment, disability, and handicap" that may be useful in considering the impact of a voice disorder. Impairment is defined as an abnormality in physical or mental function; abnormal laryngeal functioning would be considered an impairment. For example, glottal incompetence or lack of vocal fold closure as a result of recurrent laryngeal nerve paralysis or Parkinson disease would be an impairment. Disability refers to a limitation in performance of an activity because of an impairment; an impairment in laryngeal function that limits performance of an activity would be considered a disability. For example, a problem in the ability to project the voice because of glottal incompetence would be a disability. Handicap is a loss of social role function because of disability; any disadvantage imposed by the impairment or disability that limits the individual's psychosocial functioning (Erdman, 1993) is considered a handicap. For example, being unable to perform a job as a classroom teacher or courtroom attorney because of the inability to project the voice as a result of glottal incompetence would be a handicap.

A voice problem may result in a disordered self-image that together with the voice problem could be handicapping both socially and economically (White, 1946). Stress, frustration, withdrawal, and depression have been associated with the inability to produce a normal voice (Aronson, 1979; Smith et al., 1996). Smith et al. (1996) investigated the frequency and effects of voice problems on job, social, psychological, physical, and communicative aspects of quality of life in 174 individuals with voice disorders. Seventy-five percent of these individuals considered that voice problems negatively affected social functioning, in comparison with 11% of the 173 nondisordered control group. Individuals described depression related to voice disorders more commonly than the control group (65% versus 4%). It has been reported that both children (Ruscello, Lass, & Podbesek, 1988; Lass, Ruscello, Stout, & Hoffman (1991) and adults (Blood, Mahan, & Hyman, 1979) are perceived adversely when they have a disordered voice quality.

The impact of a voice disorder on employment has been investigated. Sapir, Atias, and Shahar (1990) concluded that symptoms of vocal fatigue (e.g., hoarseness, voice loss) and overuse can have a significant and widespread impact on performance and work efficiency. In a study of 237 teachers, Sapir, Keidar, and Mathers-Schmidt (1993) observed that over one third of teachers with voice problems reported that their voice problems interfered with their ability to teach effectively and that they missed work because of voice problems; one fifth of these teachers reported that their voice had been a source of chronic stress or frustration. Of the 174 individuals studied by Smith et al. (1996), most considered that their voice problems negatively affected past (53%), current (49%), and future (76%) job performance. Izdebski, Dedo, and Boles (1984) reported that in a group of 200 individuals with spasmodic dysphonia, 93% of the men and 77% of the women found that their voice disorder seriously interfered with their job performance--with 25% of the men and 37% of the women actually changing jobs. Recently King, Ramig, Dereshiwsky, and Stein (unpublished data) reported that 55% of 47 young employed individuals with Parkinson disease acknowledged that they talked less because of their voice/speech disorder. Furthermore, 54% of these

individuals expressed fear of job loss or early retirement related to their inability to meet the speaking requirements of their job. In a recent study of three employed individuals with Parkinson disease, Countryman, Ramig, Pawlas, and Thompson (1998) reported that because of voice problems, one individual was reassigned to a different position within the company. This reassignment decreased the individual's overall job satisfaction, which was associated with a reduction in his overall life satisfaction.

Individuals with certain vocations or avocations, such as teachers, telephone sales people, courtroom attorneys, tour guides, cheerleaders, actors and rock singers, may be at high risk for voice disorders. These activities place high demands on the phonatory mechanism. In some cases, the individuals use their voices for a large part of the day over loud background noise (H'etu, Truchon-Gagon, & Bilodeau, 1990); in other cases, extended speaking is done at extreme ranges of vocal performance. Over half of the 237 teachers surveyed by Sapir et al. (1993) reported symptoms of a voice disorder (e.g., voice fatigue, hoarseness, effort to talk). Students of vocal performance also reported problems with their voices. Forty-seven percent of 74 students surveyed by Sapir (1993) sought medical help for their voice problems since they began their singing career. Twenty percent reported that within the past year they had to quit performing, limit performances, or forego auditioning because of chronic voice problems.

Voice problems also have been studied in cheerleaders, and both acute (Reich, McHenry, & Keaton, 1986) and chronic (Bravender, 1980; Andrews & Shank, 1983) problems have been reported. Reich et al. (1986) reported frequent occurrence of voice loss, voice disorder, and pitch breaks in 146 cheerleaders during and immediately after a cheering event. Bravender (1980) studied 23 high school girls who had participated in cheerleading for 3 or more years and found that they were eight times more likely to exhibit clinically significant voice disorders than age-matched noncheering girls. Andrews and Shank (1983) reported that of 102 high school cheerleaders, 37% had a history of vocal problems. Data from these studies suggest that individuals who use their voices in such a manner are highly susceptible to voice problems.

## Role of the Speech-Language Pathologist in Managing Individuals With Voice Disorders

Speech-language pathologists have an essential role in the management of individuals with voice disorders. Proper treatment of voice may play a key role in restoring and preserving the individual's quality of life and possibly economic situation. After the interdisciplinary team of the speech-language pathologist and otolaryngologist evaluates an individual, behavioral voice treatment may be recommended for a number of reasons. Behavioral voice treatment may be (a) the preferred treatment to resolve the voice disorder when medical (surgical or pharmacological) treatments are not indicated, (b) the initial treatment in cases where medical treatment appears indicated and may obviate the need for medical treatment, (c) completed before and after laryngeal surgery to maximize long-term post-surgical voice, and (d) a preventative treatment to preserve vocal health.

## Evidence of the Benefits of Voice Treatment

**Summary of pertinent voice treatment efficacy research.** Descriptions of behavioral voice treatment are found in the professional literature from the fields of speech-language pathology, otolaryngology, neurology, and vocal performance. Whereas specific voice treatment techniques have been described and recommended in many books published in the past 15 years (e.g., Andrews, 1991; Aronson, 1990; Blitzer, Brin, Sasaki, Fahn, & Harris, 1992; Boone & McFarlane, 1988; Brown, Vinson, & Crary, 1996; Case, 1991; Colton & Casper, 1996; Fawcus, 1986; Ford & Bless, 1992; Gould, Sataloff, & Spiegel, 1993; Greene & Mathieson, 1989; Johnson, 1995; Martin, 1987; Morrison & Rammage, 1994; Prater & Swift, 1987; Ramig, Pawlas, & Countryman, 1995; Rubin, Sataloff, Korovin, & Gould, 1995; Sataloff, 1991; Stemple, 1993; Stemple, Glaze, & Gerdemann, 1995; Titze, 1994; Wilson, 1987) and have been reviewed in many articles (e.g., Hillman, Gress, Hargrave, Walsh, & Bunting, 1990; Mathieson, 1989; McFarlane, 1988; Moore, 1977; Mueller & Larson, 1993; Perkins, 1985; Ramig, 1992; Ramig & Verdolini, 1997; Reed, 1980; Verdolini, Ramig, & Jacobson, 1997), this report will focus on data-based research articles that evaluate the effectiveness or efficacy of behavioral treatment techniques through group designs, single-subject experimental designs, retrospective analyses, case studies, and program evaluation data.

The documentation of successful behavioral treatment of voice disorders includes data to support the

effectiveness of treatment designed to teach reduction of vocal misuse, hyperfunction and muscular imbalance, compensation or correction for the effects of a medical or physical condition on the larynx, and optimum voice production in the presence of a psychogenic disorder. The goal of behavioral voice treatment is to maximize vocal effectiveness relative to the existing laryngeal disorder and to reduce the handicapping effect of the voice problem.

## Voice Disorders Related to Misuse and Hyperfunction

Voice disorders of misuse and hyperfunction may lead to vocal fatigue or voice loss as well as such physical pathologies as edema, vocal nodules, vocal polyps, and contact ulcers/granuloma. Experimental and clinical data have been reported both for specific techniques as well as general vocal hygiene programs. The goal of these approaches is to reduce laryngeal hyperfunction and muscular imbalance and to optimize laryngeal health in order to reduce or eliminate edema, vocal nodules, polyps, or contact ulcers and thus to improve the voice and obviate the need for laryngeal surgery or maximize its long-term results.

Data exist for such specific techniques as electromyographic (emg) biofeedback of laryngeal muscle activity in adults (Andrews, Warner, & Stewart, 1986; Prosek, Montgomery, Walden, & Schwartz, 1978; Stemple, Weiler, Whitehead, & Komray, 1980) and children (Allen, Bernstein, & Chait, 1991), progressive relaxation (Andrews et al., 1986), yawn-sigh (Boone & McFarlane, 1993; Brewer & McCall, 1974), laryngeal massage (Roy & Leeper, 1993; Roy, Bless, Heisey, & Ford, in press), the Accent Method (Fex, Fex, Shiromoto, & Hirano, 1994; Kotby, El-Sady, Basiouny, Abou-Rass, & Hegazi, 1991; Smith & Thyme, 1976), the chewing method (Brodnitz & Froeschels, 1954), vocal intensity reduction (Halbrook, Rolnick, & Bally, 1974; Lodge & Yarnall, 1981), pitch elevation (Fisher & Logemann, 1970; McFarlane, 1988), cough reduction (Zwitman & Calcaterra, 1973), vocal function exercises (Sabol, Lee, & Stemple, 1995; Stemple, Lee, D'Amico, & Pickup, 1994), and confidential and resonant voice therapy (Verdolini-Marston, Burke, Lessac, Glaze, & Caldwell, 1995).

For example, 15 of the 18 individuals with hyperfunction treated cumulatively across the Prosek et al. (1978), Stemple et al., (1980), Andrews et al., (1986), and Allen et al., (1991) studies were able to reduce laryngeal muscle tension and improve vocal quality through use of EMG biofeedback. Andrews et al. (1986) reported maintenance of these changes 3 months after treatment, and Allen et al. (1991) reported elimination of vocal nodules at 6-month follow-up.

More general vocal hygiene approaches--which include education about healthy voice care, optimum use of the voice and elimination of abusive habits, and increased hydration--have generated similar data. These approaches include reduction of vocal hyperfunction and physical vocal pathology and improved phonation (Bloch & Gould, 1974; Bloch, Gould, & Hirano, 1981; Blood, 1994; Chan, 1994; Drudge & Philips, 1976; Murry & Woodson, 1992; Peacher, 1947, 1961; Peacher & Hollinger, 1947; Verdolini-Marston, Sandage, & Titze, 1994; Yamaguchi, Yotsukura, Kondo, Hanyuu, Horiguchi, Imaizumi, & Hirose, 1986). Beginning with Peacher's work in 1947, the significance of vocal hygiene in the management of individuals with contact ulcer has been documented. Peacher concluded that of the 16 individuals she studied (6 treated; 10 untreated), the ulcer did not improve unless the individual changed his/her style of voicing. More recent data (Bloch et al., 1981) supported these findings in a study of 17 men with contact ulcers who received vocal hygiene treatment. Such treatment was successful in eliminating the ulcer in 12 of these patients/clients. In a case study, Bloch and Gould (1974) reported that after 2 months of voice treatment, the individual's ulcer was improved, and at 4 months, it was gone. Verdolini-Marsden et al. (1994) administered hydration treatment and a placebo treatment to six women with vocal nodules or polyps in a double-blind placebo-controlled study. Improvements in perceptual and instrumental measures of voice were greater with the hydration treatment than with the placebo. Chan (1994) administered a vocal hygiene program to 12 kindergarten teachers. When compared to an untreated control group, these teachers improved their voices--as reflected in acoustic and electroglottographic measures.

Retrospective studies have been carried out to evaluate the effectiveness of behavioral voice treatment administered in combination with surgical or other medical management of individuals with disorders of misuse and hyperfunction, such as vocal nodules. Behavioral voice treatment was deemed a significant factor in improving the characteristics of the voice and in reducing the post-surgical recurrence of the laryngeal pathology (Baker, 1954; Cooper & Nahum, 1967; Kaufman & Blalock, 1989; Lancer, Syder, Jones, & Le Boutiller, 1988; Murray & Woodson, 1992; Peacher, 1960; Peacher & Hollinger, 1947). For example,

Lancer et al. (1988) concluded that voice treatment (with or without surgery) reduced the incidence of recurrence of vocal nodules in the 34 individuals they studied. They recommended offering individuals with vocal nodules a course of voice treatment in addition to, or instead of, surgical removal. McFarlane and Watterson (1990) reported on 44 individuals with vocal nodules that resolved with voice treatment using a combination of vocal hygiene, abuse reduction, and vocal reeducation. Murray and Woodson (1992) reached similar conclusions after their study of 59 patients with vocal nodules. They concluded that because the results of treatment with or without surgery may be comparable, behavioral voice treatment should be considered as the first recommendation for treatment of vocal nodules.

A cumulative sample size of 185 individuals were considered in a number of similar retrospective studies on the combined role of behavioral and surgical treatment for contact ulcers (Baker, 1954; Cooper & Nahum, 1967; Holinger & Johnson, 1960; Peacher, 1960; Watterson, Hansen-Magorian, & McFarlane, 1990). These studies concluded that voice treatment alone was successful in resolving the ulcer in the majority of cases. Holinger and Johnson (1960) stated that "surgical removal of the granulomatous mass was necessary in some cases, but it was shown that this is only partially effective if voice correction and reeducation procedures are not used." Peacher (1960) reported that of 70 patients with contact ulcers who received voice treatment, no recurrence was observed in 65 patients 12 years after treatment. More recently, Watterson et al. (1990) reported that voice treatment was recommended most often by the otolaryngologist as the treatment of choice in 67% of their 57 cases of contact ulcer, followed by medical management of gastric reflux (Koufman, 1991). When surgery was recommended in a third of the cases, it was usually followed by voice treatment.

Koufman and Blalock (1989) reported on the effects of presurgery voice treatment in 126 adults who received surgery for benign or malignant laryngeal lesions. Of the individuals who received presurgical voice treatment, 16% had prolonged postoperative dysphonia, compared with 54% of those individuals who did not receive presurgery voice treatment.

There has been some controversy about the benefits of voice treatment for vocal hyperfunction and vocal nodules in children (Kahane & Mayo, 1989; Kay, 1982; Sanders, 1989; Schearer, 1972; Toohil, 1975). Although some data suggest that voice treatment is not helpful (Kay, 1982; Toohil, 1975) or necessary (Sanders, 1989), the consensus is that children with vocal hyperfunction and vocal nodules should receive voice treatment. In a survey of 535 otolaryngologists, Moran and Pentz (1987) reported that 59% preferred voice treatment as the sole mode of treatment for vocal nodules in children. Less than 1% of the responding otolaryngologists preferred surgery as the sole treatment (i.e., without behavioral voice treatment). Deal, McClain, and Sudderth (1976) reported on 31 school-age children with vocal nodules who underwent 2 months of voice treatment. Immediately after treatment, 21 (68%) of the children had reduced nodule size, and 7 (23%) had normal larynges. After 6 months of treatment, 26 (84%) of the children had reduced nodule size, and of those 20 (65%) had normal larynges. Given the relationship between childhood and adult vocal problems (Cooper, 1973; Pahn, 1966), as well as the social and academic consequences of a communication disorder (Bennett & Runyan, 1982), it has been concluded that voice treatment is beneficial for children with vocal nodules (Kahane & Mayo, 1989). It has been reported that between 45% and 80% of childhood dysphonias are caused by vocal nodules (Baynes, 1966; Herrington-Hall et al., 1988). Half of the otolaryngologists sampled in the Moran and Pentz (1987) study and 82% in the Allen, Pettit, and Sherblom (1991) study reported that voice treatment is frequently or always effective in the treatment of vocal nodules in children. The Vocal Abuse Reduction Program (VARP; Johnson, 1985) is one approach to the treatment of misuse and vocal hyperfunction in school-age children. Johnson and Parrish (1971) reported that 34 of 40 children were successfully remediated for vocal hyperfunction through use of VARP. Another approach to management of vocal hyperfunction in the schools has been vocal hygiene classroom programs (Flynn, 1983; Nilson & Schneiderman, 1983). Nilson and Schneiderman (1983) reported the results of a vocal hygiene program administered to 155 students between the ages of 6 and 8 years in second and third grades. These students received 2.5-hour vocal hygiene sessions two times a week for 2 weeks. Close to 8% (7.7%) of the children were rated hoarse before the vocal hygiene sessions, and 5.8% were rated hoarse after the sessions. Five months later, the children demonstrated recall of the content of the vocal hygiene sessions.

There are experimental and clinical data to support the effectiveness of specific techniques as well as general vocal hygiene approaches for the treatment of vocal hyperfunction, misuse, and muscular imbalance disorders in both children and adults. In some cases, combined medical (surgical, pharmacological) and behavioral treatments may be indicated. Select studies are summarized in Table 1. Retrospective analyses

add support to these findings. Two case studies are included at the end of this report to demonstrate application of behavioral treatment to remediation of vocal hyperfunction in a child and in an adult.

## Voice Disorders Related to Special Medical or Physical Conditions

Voice disorders related to special medical or physical conditions may be considered in relation to changes in vocal fold adduction or vibratory stability. Vocal fold adduction may be reduced (hypoadduction) or increased (hyperadduction), and vocal fold vibratory instabilities may occur (Ramig & Scherer, 1992; Smith & Ramig, 1995). Treatment techniques are designed to increase or decrease vocal fold adduction and to improve the regularity of vocal fold vibration. Although in some cases, behavioral treatment alone can be useful, in many cases a combined medical (surgical, pharmacological) and behavioral approach is necessary and most beneficial for these disorders.

Reduced vocal fold adduction (hypoadduction) may be caused by laryngeal trauma and result in conditions such as recurrent laryngeal nerve paralysis. Reduced vocal fold adduction may also accompany neurological disorders such as Parkinson disease, multiple sclerosis, closed head injury, and stroke and congenital conditions such as sulcus vocalis (vocal fold furrow).

Data exist for vocal fold adduction exercises for forms of glottal incompetence resulting from laryngeal nerve paralysis and sulcus vocalis (Froeschels, Kastein, & Weiss, 1955; Kotby et al., 1992; Yamaguchi et al., 1993). For example, Yamaguchi et al. (1993) reported on cases of glottal incompetence associated with paralysis and sulcus vocalis that were treated with the pushing technique. All three individuals improved following voice treatment; two individuals improved approximately 20 decibels (reflecting a statistically significant increase in intensity), and one individual improved 7 decibels (reflecting a clinically significant increase in intensity).

Increasing vocal fold adduction is one aspect of the Lee Silverman Voice Treatment (LSVT) developed for individuals with idiopathic Parkinson disease. This approach, which includes intensive (daily for 16 sessions within one month) high phonatory effort exercises, has been documented to have short- and long-term effectiveness for individuals with idiopathic Parkinson disease (Countryman, Hicks, Ramig, & Smith, 1997; Dromey, Ramig, & Johnson, 1995; Ramig, Bonitati, Lemke, & Horii, 1994; Ramig, Countryman, Thompson, & Horii, 1995; Ramig, Countryman, O'Brien, Hoehn, & Thompson, 1996) and atypical Parkinson disease (Countryman & Ramig, 1993; Countryman, Ramig, & Pawlas, 1994). This treatment program includes exercises for increasing vocal fold adduction, maximum fundamental frequency range, and respiratory support. In addition, individuals with Parkinson disease are trained in sensory self-monitoring (Ramig, Pawlas, & Countryman, 1995). Videolaryngostroboscopic observations have documented increased vocal fold adduction following the LSVT in individuals with Parkinson disease (Smith, Ramig, Dromey, Perez, & Samandari, 1995). Aerodynamic observations have demonstrated increased subglottal air pressure and maximum flow declination rates (Dromey, Ramig, & Johnson, 1995; Ramig & Dromey, 1996) consistent with increased respiratory drive and vocal fold adduction following treatment. The role of voice treatment in improving oral communication in individuals with Parkinson disease has been reported by others as well (Johnson & Pring, 1990; Robertson & Thompson, 1984; Scott & Caird, 1983). (See Yorkston, 1996, for a review of treatment efficacy articles on Parkinson disease.)

In addition to the documented effects of LSVT on speech and voice production, individuals with Parkinson disease reported a significant reduction of the impact of their disease on their communication (Sickness Impact Profile-Communication; Berger, Bobbit, Carter, & Gilson, 1981) post-treatment. This finding supports the role of intensive voice treatment in reducing the handicap of the voice disorder in these individuals. Recently, the relationship between improved speech and employment has been studied in employed individuals with Parkinson disease (Countryman, Ramig, Pawlas, & Thompson, 1998). The findings of this preliminary work were consistent with a positive relationship between improved speech production and impact on the employment situation as measured by Job Satisfaction Scale (Brayfield & Rathe, 1951), Minnesota Satisfactoriness Scale (Gibson, Weiss, Dawus, & Lofquist, 1970), and personal interview.

In many cases of medical and physical conditions that affect the voice, it is necessary to consider the combined and alternative roles of medical (surgical and pharmacological) and behavioral treatments to optimize outcomes. McFarlane, Holt-Romero, Lavorato, and Warner (1991) recently compared the impact of

medical, surgical, and behavioral interventions with recurrent laryngeal nerve paralysis. They compared voice quality following voice treatment alone, teflon injection, and muscle-nerve reinnervation surgery in 16 patients with vocal fold paralysis. They reported that voice quality was rated better following voice treatment alone (n = 6) when compared to teflon injection (n = 4) and was rated the same when compared to muscle-nerve reinnervation (n = 6). McFarlane et al. (1991) suggest a presurgical trial period of voice treatment for patients with unilateral vocal fold paralysis who have a competent cough and do not have aspiration problems.

Program evaluation data on 110 cases of recurrent laryngeal nerve paralysis have been provided by Sataloff (personal communication, 1994). All individuals participated in speech treatment alone or before or after surgical procedures. Eighty-two percent of the women (41/50) and men (45/55) received speech and singing treatment only, while 18% of the women (9/50) and men (10/55) required surgery. Surgical procedures included arytenoid adduction (for concomitant dislocation), thyroplasty, lipoinjection, or mass removal. Additional program evaluation data on 55 cases of unilateral vocal fold paralysis were reported by Casper, Colton, Woo, and Brewer (1994). These individuals ranged in age from 38 to 60 years. Four interventions were compared: the tincture of time, teflon injection, thyroplasty, and voice treatment. All interventions improved phonatory function--as documented by perceptual, acoustic, and aerodynamic measures; there were no significant differences among interventions. These program evaluation data support voice treatment as a reasonable, cost-effective alternative to surgical intervention in many cases.

Problems with excess vocal fold adduction (hyperadduction) occur in such disorders as spasmodic dysphonia. The importance of combined medical and behavioral approaches to voice disorders has been demonstrated through approaches to this disorder. Although the etiology of spasmodic dysphonia has been debated (e.g., Aronson, 1990), resistance to behavioral treatment has been reported consistently (e.g., Harrison, Davis, Troughear, & Winkworth, 1992). However, both surgical (recurrent laryngeal nerve section; e.g., Dedo, 1976) and pharmacological (botulinum toxin; e.g., Blitzer, Brin, Fahn, & Lovelace, 1988) treatments have documented effectiveness. A recent report by Murry and Woodson (1995) supported the role of behavioral voice treatment in maximizing the duration of vocal improvement following treatment with botulinum toxin.

Paradoxical vocal cord dysfunction or Vocal Cord Dysfunction (VCD) was described by Christopher, Wood, Eckert, Blager, Raney, and Souhrada (1983) in individuals diagnosed with severe asthma. Since that time, various subgroups and characteristics of this disorder have been presented (Newman & Dubester, 1994; Lanwehr, Wood, Blager, & Milgrom, 1996; Martin, Blager, Gay, & Wood, 1987). Recently, Blager (in press) reported retrospective data on 40 pediatric individuals, 12 with VCD and 28 with VCD and asthma. Twenty-seven (90%) of these individuals reported significant improvement in controlling VCD after two or more speech treatment sessions using Relaxed Throat Breathing Techniques. On follow-up, an average of 2 years 4 months later, four reported no VCD attacks, and 21 (64%) reported using relaxed throat breathing techniques alone or in combination with asthma medications.

There are experimental and clinical data to support the effectiveness of select techniques as well as combined medical (surgical and pharmacological) approaches to the treatment of voice disorders resulting from medical physical conditions. Select studies are summarized in Table 1. Retrospective analyses and program evaluation data add support to these findings. Two case studies are included at the end of this report to demonstrate application of behavioral treatment to remediation of the voice disorders accompanying vocal fold paralysis and Parkinson disease.

## **Voice Disorders Associated With Psychological Stress**

Voice disorders associated with psychological stress include diagnoses of musculoskeletal tension dysphonia, conversion dysphonia/aphonia, and mutational falsetto. Elias, Raven, Butcher, and Littlejohns (1989) surveyed 244 speech-language pathologists and reported that 75% have treated patients/ clients with psychological voice disorders. Experimental and clinical data reported for psychological voice disorders include specific techniques as well as combined psychological counseling and voice treatment (Aronson, 1969; Boone, 1966; Bridger & Epstein, 1983; Butcher, Elias, Raven, Yeatman, & Littlejohns, 1987; Carding & Horsley, 1992; Elias et al., 1989; Hammarberg, 1987; Haywood & Simmons, 1982; Horsley, 1982; Kaplan, 1982; Kaufman & Blalock, 1988; Milutinovic, 1990; Roy & Leeper, 1993; Strandberg, Griffith, & Holowell, 1971). For example, musculoskeletal tension reduction (Roy & Leeper, 1993; Roy et al., 1997), relaxation



(Strandberg et al., 1971), and vocal elicitation procedures (Aronson, 1969; Boone, 1966; Sapir, 1995) have been reported as successful approaches to elicit and improve the voices of these individuals.

Roy and Leeper (1993) reported on the effectiveness of manual circumlaryngeal musculoskeletal tension reduction in 17 individuals diagnosed with functional dysphonia. After one treatment session ranging in duration from 1 to 3 hours, individuals improved voice quality. The improvement is reflected in a change in severity ratings from 4.75 pre- to 1.72 post-treatment. Acoustic analysis also confirmed increased vocal stability posttreatment. Roy et al. (1997) treated an additional 25 individuals with a similar diagnosis using similar techniques and reported comparable positive findings. Perceptual and acoustic data indicated improved vocal function post-treatment. Boone and McFarlane (1993) reported both acoustic and physiologic changes in 7 subjects following the yawn-sigh vocal elicitation technique. Acoustically, lowering of the second and third formant frequencies was observed, indicating evidence of enlargement of the vocal tract area consistent with relaxation and laryngeal lowering accompanying the yawn-sigh technique.

Case studies of treatment for psychogenic disorders have been reported by a number of individuals, including Aronson (1969), Boone (1966), Hartman, Daily, and Marin (1989), Sapir (1995), Strandberg et al. (1971), and Wolsky and Wiley (1965). These reports support the use of various vocal elicitation procedures (um-hum, cough, throat clear, inhalation phonation, yawn-sigh, laryngeal manipulation, and digital pressure) to elicit voice in psychogenic disorders. Aronson (1969) reported successful vocal elicitation in 39 of 40 cases.

Various retrospective studies have supported the efficacy of voice treatment for psychogenic disorders. Bridger and Epstein (1983) reported that of 109 patients with psychogenic voice disorders, 56% were "cured" by speech treatment and 26% improved their voice quality. Kaufman and Blalock (1982) studied individuals with functional voice disorders including hysterical aphonia/dysphonia ( $n = 5$ ), habituated hoarseness ( $n = 15$ ), and falsetto voice ( $n = 1$ ) and reported that voice treatment yielded excellent short- and long-term results. Mutational falsetto, a type of psychogenic voice disorder characterized by inappropriate high pitch, has been successfully treated with behavioral therapy (Hammarberg, 1984).

Program evaluation data on 27 cases of stress-related or psychogenic voice disorders were reported by Leonard (personal communication, 1994). Twenty-four of the patients were women, 3 were men. The individuals ranged in age from 13 to 71 years. Treatment included procedures designed to improve voice quality: patient education, digital manipulation, relaxation, and endoscopic feedback. Twenty of the 27 individuals resolved their disorder following voice treatment and reported good maintenance at 6 to 12 months follow-up.

There are experimental and clinical data to support the effectiveness of select techniques alone or in combination with counseling approaches for the treatment of psychogenic voice disorders. Select studies are summarized in Table 1. Retrospective analyses and program evaluation data add support to these findings. A case study is included at the end of this report to demonstrate application of behavioral treatment to remediation of a voice disorder of psychogenic origin.

## Summary

Voice production plays a critical role in self-expression, well-being, and functional daily living. Disordered voice can negatively affect personal development, employment, and productivity. The effective treatment of voice disorders can positively affect quality of life in society.

Experimental and clinical data exist to support the effectiveness of voice treatment for voice disorders related to vocal misuse, hyperfunction, and muscle imbalance, including organic changes, special medical or physical conditions, and psychological disorders. These data have been obtained from group and single-subject experimental designs, retrospective analyses, case studies, and program evaluation data. Research continues to evaluate the efficacy of treatment for voice disorders.

In order to maximize generalizability of findings, future research should include high-quality experimental designs implementing more large group studies (Campbell & Stanley, 1966; Schiavetti & Metz, 1997; Winer, 1971) as well as continued single-subject experimental designs (Barlow & Hersen, 1984; Cohen, 1988;

Kazdin, 1982; Kratochwill & Levin, 1992; McReynolds & Kearns, 1983). Studies should include measures that span functional impact with broad generalizability as well as documentation of physiologic bases for treatment-related changes. This blending of clinically useful outcomes with research quality experiments may be most feasible through a collaborative effort between clinical settings (with the large sample sizes and clinical knowledge they can contribute) and research facilities (with their experimental protocols, instrumental measures, and theory-based designs). Such combined resources may facilitate studies that are functionally relevant and scholarly sound to advance knowledge on the efficacy of voice treatment.

## Acknowledgments

Preparation of this paper was made possible in part by NIH-NIDCD Grants No. R01 DC01150, K08DC00139, P60DC00976 and OE-NIDRR Grant No.813340108. Gratitude is expressed to the numerous individuals (including Janina Casper, Daniel Boone, Steve McFarlane, Robert Sataloff, Maya Andrews, Charles Reed, Kristen Baker, Stefanie Countryman, & Annette Arnone Pawlas) who reviewed various drafts of this paper. Appreciation is also expressed to Cynthia Fox, Geron Coale, Heather Hughes, Patricia Hoyt, and Stephanie Hinds who assisted in important ways at various times during the development of this paper.

## TABLE 1. Selected studies on the effect of voice treatment.

Legend for Chart:

A - Disorders  
 B - Reference  
 C - Subjects  
 D - Treatment(s)  
 E - Design  
 F - Measures  
 G - Results

A

B  
 C  
 D  
 E  
 F  
 G

Voice-use related

Stemple et al., 1980

Patients: 7 men and women with nodules. Control data: 21 men and women without history of vocal pathology.

All patients received EMG biofeedback. Seven feedback and 1 no-feedback sessions provided within 4 wk.

ABA reversal design. Patient pre-post data were compared to normative data.

(1) EMG in silence and PB words; (2) voice quality in PB words; (3) laryngeal appearance by indirect laryngoscopy.

In patients, pre-treatment laryngeal tensions were abnormally high. Tensions were significantly reduced to normal at 2-wk. follow-up. Laryngeal appearance improved in 5/6 subjects, with nodules resolved in 3/6 subjects.

## Voice-use related

Andrews et al., 1986

10 women with hyperfunctional voice disorders involving physical changes (N = 6) and no physical changes (N = 4). Subjects were matched into 5 pairs.

(1) Progressive relaxation; or (2) EMG biofeedback.  
Treatment provided once weekly from 4 to 36 wk.

Prospective, between-subject design. Assignment to treatment alternating within matched pairs.

Primary measures were (1) EMG during rest and during voice tasks (maximum prolongation, pitch glides, sentences); (2)  $F_0$  contour during voice tasks; (3) auditory parameters of phonation.

(1) EMG was lower post-treatment for both groups during rest and during speech; (2)  $F_0$  contour significantly improved in EMG group, not relaxation group; (3) voice quality appeared to improve in both groups; (4) benefits were retained at 3-mo follow-up.

## Voice-use related

Koufman & Blalock, 1989

127 adult subjects who received surgery for benign and malignant laryngeal lesions

Various combinations of surgery, pre-surgical and post-surgical voice treatment

Retrospective, based on clinical data.

Duration of post-operative dysphonia (prolonged = 4 wk or greater).

16% of patients who received preoperative voice treatment had prolonged post-operative dysphonia. 54% of patients who did not receive pre-operative treatment had prolonged post-op dysphonia (significant).

## Voice-use related

Blood, 1994

2 women with nodules

(1) Computer-assisted voice treatment protocol = education, abuse reduction, breathing, easy onset, transfer; and  
(2) relaxation

Prospective, single-subject interaction design, with multiple baselines across subjects. A, B, B + C, B, B + C, follow-up design where A = baseline (5-9 sessions); B =

voice treatment protocol (3 sessions); B + C = voice treatment protocol + relaxation (3 sessions); follow-up = 3 sessions over 3-mo post-treatment period.

(1) Number of vocal abuses and misuses; (2)  $F_0$  and perturbation on vowels; (3) breathing parameters including easy phonatory onset; (4) MPT /a/; (5) subjective relaxation ratings; (6) subject ratings of voice improvement and clinician auditory ratings of voice quality.

Descriptive results compared baseline and follow-up measures. All measures improved in both patients. Nodules were eliminated. Relaxation training did not appear to enhance benefits. Improvements were retained at follow-up.

#### Voice-use related

Verdolini-Marston et al., 1994

6 women with nodules or polyps

(1) Hydration; and (2) placebo

Prospective double-blind, placebo-controlled, within-subject design. Each treatment delivered over 5 days, with post-treatment measures one day after.

(1) Phonatory effort; (2) phonation threshold pressure; (3) voice quality; (4) jitter, shimmer, SNR; (5) laryngeal appearance.

Pre-post treatment improvements were seen for both hydration and placebo treatments. At 1-day follow-up, jitter was significantly more improved following hydration. Similar trends were seen for other measures except SNR, in which hydration and placebo improvements were equivalent.

#### Voice-use related

Verdolini-Marston et al., 1995

13 women with nodules

(1) Resonant Voice Therapy or Confidential Voice Therapy, + vocal hygiene; or (2) vocal hygiene only (control group)

Prospective, matched alternating assignment.  
Between-subjects design.

(1) Phonatory effort; (2) voice quality; (3) laryngeal appearance.

At 2-wk. follow-up, a significant proportion of treatment subjects improved on combined measures. No significant improvement was obtained in controls. There was no statistical difference in results for 2 groups.

#### Special medical conditions

Scott & Caird, 1983

26 adults with Parkinson disease

(1) Prosodic exercises with Vocalite; or (2) prosodic exercises without Vocalite. Five 1-hr sessions weekly, for 2 wk, plus extra wk of treatment in no Vocalite group.

Prospective, random assignment. Between-subjects design.

(1) Ordinal prosody scores;  
(2) ordinal intelligibility scores.

Subjects in both groups improved significantly in both measures with treatment. Gains deteriorated after 3 mo. of treatment withdrawal, but not to baseline.

Special medical conditions

Robertson & Thompson, 1984

22 adults with Parkinson disease (18 completed protocol)

(1) Intensive traditional group speech treatment, and individual treatment if needed; or (2) control group. Treatment group received 3-1/2 to 4 hr treatment daily.

Prospective, random assignment.

Dysarthria Profile measures (Robertson, 1982).

Treatment group showed significantly better average score post-treatment than control group (initially equivalent). Treatment group also showed continued improvements at 3-mo follow-up; control group did not.

Special medical conditions

Johnson & Pring, 1990

12 adults with Parkinson disease

(1) Traditional group speech treatment; or  
(2) Control group. Treatment provided in 10 sessions over 4 wk.

Prospective, random assignment of matched subjects. Between-subjects design.

(1) Frenchay Dysarthria Assessment (Enderby, 1983); (2) maximum intensity; (3) intensity range; (4) speech intensity; (5) reading intensity; (6)  $F_0$ ; (7) pitch range; (8) modal pitch speech; (9) modal pitch reading.

Immediately following the 4-wk period, treatment subjects showed significant Improvement on all measures. Control group deteriorated or did not improve on any measure.

## Special medical conditions

Ramig, Countryman, Thompson, & Horii, 1995

45 adults with Parkinson disease

- (1) Lee Silverman Voice Treatment (LSVT); or
- (2) respiration therapy. Sixteen sessions over 4 wk.

Prospective, random assignment within stratified groups.  
Between-subjects design.

(1) Sound pressure level sustained vowel phonation, reading, and monologue; (2) maximum sustained vowel phonation duration; (3)  $F_0$ ; (4) semitone SD in reading and monologue; (5) FVC; (6) subject and family ratings of loudness, prosody, voice, quality, intelligibility, tendency to initiate conversation.

More measures improved for LSVT group. Only LSVT subjects perceived a reduction in effect of disease on communication.

## Special medical conditions

Ramig, Countryman, O'Brien, Hoehn, & Thompson, 1996

35 adults with Parkinson disease

- (1) Lee Silverman Voice Treatment; or (2) respiration therapy. Sixteen sessions within one month.

Prospective, random assignment within stratified groups.  
Between-subjects.

(1) Sound pressure level sustained vowel phonation, reading, monologue; (2)  $F_0$ ; (3) semitone SD in reading and monologue; (4) FVC.

(1) Immediately, 6 & 12 mo. posttreatment, LSVT, not respiratory treatment, showed significant imp. in sustained vowel and reading intensity. At 12 months, LSVT group averaged a 1-2 dB increase in conversation; respiratory group averaged 1-2 dB decrease. (2) Immediately, 6 and 12 mo. post-treatment, LSVT, not respiratory group, showed significant increase in ST SD. (3) FVC: no findings either group.

## Special medical conditions

Murry & Woodson, 1995

27 adults with adductor spasmodic dysphonia

- (1) Botox + voice treatment (N = 17); or (2) Botox alone (N = 10)

Prospective; group assignment based on patient preference.

(1) Mean air flow rate; (2) jitter, shimmer, SNR;  
(3) length of time to reinjection.

(1) Upon spontaneous presentation for repeat Botox, treatment subj. had sig. higher air flow rates than Botox-only subj. (2) Upon rep., treatment subj. had significant improvements in jitter, shimmer, and SNR. Botox-only subj. had significant improvement only in shimmer. (3) Treatment subj. had greater duration between injections than non-treatment subj.

#### Functional

Roy & Leeper, 1993

17 adults with functional voice disorders

All subjects received one 1-3 hr. session of interview and manual laryngeal muscle tension reduction (Aronson, 1990).

Nonexperimental.

(1) Perceptual severity rating from reading and prolonged vowel; (2) jitter, shimmer, SNR from connected speech and prolonged vowel.

(1) Perceptual ratings improved significantly with treatment, in most cases to normal or near-normal; (2) jitter, shimmer, and SNR improved significantly in speech.

#### Functional

Butcher, Elias, Raven, Yeatman, & Littlejohns, 1987

19 adults (11 F, 8 M) with functional component to aphonia or dysphonia (N = 18) or spasmodic dysphonia (N = 1) who did not improve with prior voice treatment

Cognitive-behavior

12/19 patients entered CB treatment (patient with SD did not).

Responded/did not respond to voice treatment.

6/12 patients responded to treatment.

#### Functional

Aronson, 1969; Boone, 1965

43 patients with psychogenic or functional aphonia, across 2 studies. A total of 5 patients described specifically.

Counseling, vegetative maneuvers, positioning maneuvers

Retrospective. All patients received treatment.

Return of voice.

41/43 patients reacquired voice, with one or few sessions.  
No return of symptoms noted, at up to 1-2 year follow-up  
(Boone, 1968).

## Case Study 9-Year-Old Boy With Vocal Nodules

### **Background Information**

Allen, Bernstein, and Chait (1991) reported a study that was designed to provide assessment of EMG biofeedback in the reduction of laryngeal muscle tension in a child with hyperfunctional dysphonia.

### **Treatment History**

The individual seeking treatment was a 9-year-old boy with a 5-year history of hyperfunctional dysphonia. He had been unresponsive to traditional voice treatment (i.e., vocal abuse prevention, relaxation training, vocal rehabilitation). Vocal nodules developed and surgery was recommended. Voice treatment was recommended to reduce muscle tension so that following surgery the nodules would not return.

### **Treatment Progress**

Surface EMG (thyrohyoid membrane), subglottal pressure, videoendoscopic images, and perceptual ratings of voice were measured before and after treatment and at follow-up sessions. EMG biofeedback training was introduced in a multiple baseline design. The individual was seen biweekly for a 30-minute visual biofeedback training session. The individual was instructed to attempt to reduce muscle tension around the vocal cords by observing visual feedback about laryngeal muscle tension.

The results of the study documented that resting and speaking EMG levels were reduced from baseline to the end of treatment. The reduced EMG levels were maintained at 3- and 6-month follow-up sessions. Subglottal air pressure data decreased to normal levels post-treatment, as did perceptual rating of voice quality. Pre-treatment vocal nodules had been described as "large and prominent." Nodules were reported to be "dramatically reduced" in size at 3 months and gone at 6 months post-treatment. The plans for surgery were canceled.

## Case Study 20-Year-Old Woman With Vocal Nodules

### **Background Information**

Blood (1994) reported a study that was designed to provide an assessment of vocal re-education, computer-assisted biofeedback, and relaxation treatment for reduction of hyperfunctional voice disorders.

### **Treatment History**

One individual seeking treatment was a 20-year-old woman with an 8-month history of disordered voice. She complained of tension, intermittent breathiness, loss of volume, and tender laryngeal and neck muscles. Her lifestyle included the stress of being a full-time student on academic probation, holding a part-time job selling on the telephone, and participating in active socializing—often in loud, smoke-filled rooms. Laryngeal examination revealed bilateral vocal nodules.

### **Treatment Progress**

The number of vocal abuses and misuses, fundamental frequency, perturbation measures, maximum



phonation duration, relaxation ratings, and self-ratings of voice quality were among the variables measured before and after treatment and at follow-up sessions. The treatment included vocal re-education about abuses and misuses, computer-assisted respiratory training, easy onset of volume, and relaxation training. Nine baseline, 12 treatment, and 3 follow-up sessions were carried out.

Post-treatment, the vocal nodules were gone, and the vocal folds were described as normal. The following improvements were reported post-treatment: the frequency of vocal abuses and misuses decreased, fundamental frequency increased, perturbation decreased, maximum duration phonation increased, rated relaxation increased, and self-rating of voice quality increased. These improvements were maintained over the 3-three month follow-up period.

## Case Study 32-Year-Old Woman With Unilateral Vocal Fold Paralysis

### **Background Information**

McFarlane (1988) reported a case that documented the effect of increased vocal fold adduction exercises on a woman with unilateral vocal fold paralysis. Voice was reduced in loudness and hoarse.

### **Treatment History**

The individual seeking treatment was a 32-year-old woman bank teller with the diagnosis of unilateral vocal fold paralysis following thyroid surgery approximately one year earlier. Laryngeal examination revealed a large posterior glottal gap, visible during phonation. The right cord was paralyzed in the paramedian position, and the healthy left cord was unable to approximate it.

### **Treatment Progress**

Two sets of approaches were used in treatment to increase vocal fold adduction: pushing and pulling exercises and head turn with staccato /ee/ phonation. These approaches are designed to maximize vocal fold closure. After 14 sessions of voice treatment, the individual achieved a near-normal voice in terms of loudness, pitch, and quality. She took a position as a receptionist that involved greeting patients and answering the phone.

## Case Study 45-Year-Old Man With Idiopathic Parkinson Disease

### **Background Information**

Dromey, Ramig, and Johnson (1995) reported a study that was designed to provide assessment of the effect of high-effort intensive voice treatment (Lee Silverman Voice Treatment; LSVT) on the speech and voice of an adult with idiopathic Parkinson disease.

### **Treatment History**

The individual seeking treatment was a 45-year-old family physician who was diagnosed with Idiopathic Parkinson disease 2 years earlier and was considered at Stage 2 on the Hoehn and Yahr (1967) Parkinson disease rating scale. He reported that his voice had become soft and raspy. His pre-treatment laryngeal exam was rated "bowed" (medial glottal gap) by four "blind" judges.

### **Treatment Progress**

Sound pressure level during sustained phonation, reading, and monologue; mean fundamental frequency and its variability (STSD) during reading and monologue; phonatory stability (jitter, shimmer, coefficient of variance of frequency, and amplitude and harmonics-to-noise ratio); estimated subglottal air pressure,

laryngeal airway resistance, open quotient, maximum flow declination rate during syllable repetition and articulatory acoustic measures were among the variables measured pre-and post-treatment as well as 6 and 12 months after treatment. The individual was seen for 16 treatment sessions in one month. High-effort voice exercises and sensory feedback training (Lee Silverman Voice Treatment, LSVT; Ramig, Pawlas, & Countryman, 1995) were administered.

The results documented improvements in SPL, STSD, phonatory stability, estimated subglottal air pressure, laryngeal airway resistance, open quotient, maximum flow declination rate, and articulatory acoustic measures in all conditions from pre- to post-treatment and maintenance of these changes up to 12 months without additional treatment. At post-, 6-, and 12-month follow-up treatments the individual was judged to have improved glottal closure and reduced supraglottic hyperfunction. The individual reported significant improvement in his voice post-treatment. He indicated that his wife commented that his post-treatment voice was "back to the voice" he had when she first met him.

The findings were interpreted to support positive effects of treatment as well as maintenance of these effects without additional treatment in this individual with a progressive neurological disorder. These findings suggest that increased vocal fold adduction and subglottal air pressure were a key combination in increasing vocal loudness in this individual and that together with training in sensory perception of effort this individual was able to functionally use and maintain these improvements. Furthermore the articulatory acoustic findings were consistent with an overall amplitude scale-up across the speech mechanism to contribute to improved speech production post-treatment.

## Case Study 26-Year-Old Man With a Voice Disorder of Psychogenic Origin

### **Background Information**

Aronson (1969) reported a case that documented the effectiveness of voice treatment (interview, discussion, and vocal elicitation activities) on a case of a voice disorder from psychogenic origin.

### **Treatment History**

The subject was a 26-year-old police officer who had never been happy with his work. He reported that he had never told anyone about his feelings toward his work for fear of disappointing his parents (who felt positive about his vocation). He was a quiet, unaggressive person who found it difficult to lose his temper. He reported that he found it difficult to reprimand motorists or pedestrians because of a strong need to be liked by everyone. He had had several previous episodes of aphonia and dysphonia that had cleared up spontaneously. At the time he came for voice assessment, he was considered a whispering aphonic with no abnormality on laryngeal examination.

### **Treatment Progress**

Through interview, discussion, and vocal elicitation activities (cough, humming), the subject was able to regain his voice in the initial session. Reports from the psychiatrist supported a psychogenic etiology, which was consistent with the individual's conflict in asserting himself as a police officer and the secondary gain of offering a face-saving means for leaving the police force.

### **References**

Allen, K. D., Bernstein, B., & Chait, D. H. (1991). EMG biofeedback treatment of pediatric hyperfunction dysphonia. *Journal of Behavioral Therapy and Experimental Psychiatry*, 22(2), 97-101.

Allen, M. S., Pettit, J. M. & Sherblom, J. C. (1991). Management of vocal nodules: A regional survey of otolaryngologists and speech-language pathologists. *Journal of Speech and Hearing Research*, 34, 229-

235.

Andrews, M. (1991). *Voice therapy for children*. San Diego: Singular.

Andrews, M., & Shank, K. (1983) Some observations concerning the cheering behavior of school-girl cheerleaders. *Language, Speech, and Hearing Services in Schools*, 15, 37-43.

Andrews, S., Warner, J., & Stewart, R. (1986). EMG biofeedback and relaxation in the treatment of hyperfunctional dysphonia. *British Journal of Disorders of Communication*, 21, 353-369.

Aronson, A. (1990). *Clinical voice disorders*. New York: Thieme.

Aronson, A. E. (1979). *Spastic dysphonia: Retrospective study of one hundred patients*. (Unpublished manuscript.)

Aronson, A. E. (1969). Speech pathology and symptom therapy in the interdisciplinary treatment of psychogenic dysphonia. *Journal of Speech and Hearing Disorders*, 34, 321-341.

Aronson, A. E., Brown, J. R., Litin, E. M., & Pearson, J. S. (1968). Spastic dysphonia II. Comparison with essential (voice) tremor and other neurologic, and psychogenic dysphonias. *Journal of Speech and Hearing Disorders*, 33, 220-231.

Baker, D. C. (1954). Contact ulcers of the larynx. *Laryngoscope*, 64, 73-78.

Barlow, D. H., & Hersen, M. (1984). *Single case experimental designs: Strategies for behavior change*. New York: Pergamon Press.

Baynes, R. A. (1966). An incidence study of chronic hoarseness among children. *Journal of Speech and Hearing Research*, 31, 172-176.

Bennett, C. W., & Runyan, C. M. (1982). Educators' perceptions of the effects of communication disorders upon educational performance. *Language, Speech, and Hearing Services in Schools*, 13, 260-263.

Berger, M., Bobbit, R. A., Carter, W. B., & Gilson, B. S. (1981). The sickness impact profile: Development and final revision of a health status measure. *Medical Care*, 19, 787-805.

Blager, F. B. (in press). *Vocal cord dysfunction: Multi-faceted disorder*. Phonoscope.

Blitzer, A., Brin, M., Sasaki, C., Fahn, S. & Harris, K. (Eds.). (1992). *Neurological disorders of the larynx*. New York: Thieme Medical Publishers.

Blitzer, A. Brin, M., Fahn, S., & Lovelace, R. E. (1988). Localized injections of botulinum toxin for the treatment of focal laryngeal dystonia (spasmodic dysphonia). *Laryngoscope* 98, 193-197.

Bloch, C. S., & Gould, W. J. (1974). Vocal therapy in lieu of surgery for contact granuloma: A case report. *Journal of Speech and Hearing Research*, 39, 478-485.

Bloch, C. S., Gould, W. J., & Hirano, M. (1981). Effect of voice therapy on contact granuloma of the vocal fold. *Annals of Otology, Rhinology, and Laryngology*, 90, 48-52.

Blood, G. W. (1994). Efficacy of a computer-assisted voice treatment protocol. *American Journal of Speech-Language Pathology*, 3(1), 57-66.

Blood, G. W., Mahan, B. & Hyman, M. (1979) Judging personality and appearance from voice disorders.

Journal of Communication Disorders, 12, 63-68.

Boone, D. (1966). Treatment of functional aphonia in a child and an adult. *Journal of Speech and Hearing Disorders*, 31, 69-74.

Boone, D., & McFarlane, S. (1988). *The voice and voice therapy*. Englewood Cliffs, NJ: Prentice-Hall.

Boone, D., & McFarlane, S. (1993) A critical view of the yawn-sigh as a voice therapy technique. *Journal of Voice*, 7, 75-80.

Bravendar, P. (1980) The effect of cheerleading on the female singing voice. *The NATS Bulletin*, 9-12.

Brayfield, A. H. & Rathe, H. F. (1951) An index of job satisfaction. *Journal of Applied Psychology*, 35, 307-311.

Brewer, D. W., & McCall, G. N. (1974). Visible laryngeal changes during voice therapy. *Annals of Otolaryngology, Rhinology and Laryngology*, 83, 423-427.

Bridger, M. W., & Epstein, R. (1983). Functional voice disorders. A review of 109 patients. *Journal of Laryngology and Otology*, 97, 1145-1148.

Brodnitz, F. S. (1971). *Vocal rehabilitation*. Rochester, MN: American Academy of Ophthalmology and Otolaryngology.

Brodnitz, F. S., & Froeschels, E. (1954). Treatment of nodules of vocal cords by chewing method. *Archives of Otolaryngology*, 560-565.

Brown, W., Vinson, B., & Crary, M. (Eds.). (1996). *Organic voice disorders*. San Diego: Singular Publishing Group, Inc.

Butcher, P., & Elias, A. (1983) Cognitive behaviour therapy with dysphonic patients: an exploratory investigation. *Bulletin of College of Speech Therapists* 377, 1-2.

Butcher, P., Elias, A., Raven, R., Yeatman, Y., & Littlejohns, D. (1987). Psychogenic voice disorder unresponsive to speech therapy: Psychological characteristics and cognitive-behaviour therapy. *British Journal of Disorders of Communication*, 22, 93-109.

Campbell, D., & Stanley, J. (1966). *Experimental and quasi-experimental designs for research*. Chicago: R McNally.

Carding, P., & Horsley, I. (1992). An evaluation study of voice therapy in non-organic dysphonia. *European Journal of Disorders of Communication*, 27, 137-158.

Case, J. (1991). *Clinical management of voice disorders* (2nd ed.). Austin, TX: Pro-ed.

Chan, R. W. K. (1994). Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers. *Journal of Voice*, 8, 279-291.

Christopher, K. L., Wood, R. P., Eckart, R. C., Blager, F. B., & Raney, R. A. (1983). Vocal cord dysfunction presenting as asthma: An interdisciplinary analysis. *New England Journal of Medicine*, 307, 1566-1570.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Colton, R., & Casper, J. (1996). *Understanding voice problems: A physiological perspective for diagnosis and treatment*. Baltimore: Williams & Wilkins.
- Cook, J., Palaski, D., & Hanson, W. (1979). A vocal hygiene program for school-aged children. *Language, Speech, and Hearing Services in Schools* 10, 21-26.
- Cooper, M. (1973). *Modern techniques of vocal rehabilitation*. Springfield, IL: Charles C. Thomas.
- Cooper, M., & Nahum, A. M. (1967). Vocal rehabilitation for contact ulcer of the larynx. *Archives of Otolaryngology*, 85, 41-46.
- Countryman, S., Hicks, J., Ramig, L., & Smith, M. (1997). Supraglottal hyperadduction in an individual with Parkinson disease: A clinical treatment note. *American Journal of Speech-Language Pathology*, 6(4), 74-84.
- Countryman, S., & Ramig, L. (1993). Effects of intensive voice therapy on voice deficits associated with bilateral thalamotomy in Parkinson disease: A case study. *Journal of Medical Speech Language Pathology*, 1(4), 233-250.
- Countryman, S., Ramig, L., & Pawlas, A. (1994). Speech and voice deficits in Parkinsonian plus syndromes: Can they be treated? *Journal of Medical Speech Language Pathology*, 2(3), 211-225.
- Countryman, S., Ramig, L., Pawlas, A., & Thompson, L. (1998). Speech rehabilitation and short-term changes in satisfaction of employment in Parkinson disease: A preliminary multiple case study. Submitted for publication.
- Darley, F. L., Aronson, A. E., & Brown, J. R. (1969a). Clusters of deviant speech dimensions in the dysarthrias. *Journal of Speech and Hearing Research*, 12, 462-496.
- Darley, F. L., Aronson, A. E., & Brown, J. R. (1969b). Differential diagnostic patterns of dysarthria. *Journal of Speech and Hearing Research*, 12, 246-269.
- Deal, R. E., McClain, B., & Sudderth, J. F. (1976). Identification, evaluation, therapy and follow-up for children with vocal cord nodules in a public school setting. *Journal of Speech and Hearing Disorders*, 41, 390-397.
- Dedo, H. (1976). Recurrent laryngeal nerve section for spasmodic dysphonia. *Annals of Otolaryngology*, 86, 806-812.
- Dromey, C., Ramig, L. O., & Johnson, A. (1995). Phonatory and articulatory changes associated with increased vocal intensity in Parkinson disease: A case study. *Journal of Speech and Hearing Research*, 38, 751-763.
- Drudge, M. K., & Philips, B. J. (1976). Shaping behavior in voice therapy. *Journal of Speech and Hearing Disorders*, 49, 398-411.
- Elias, A., Raven, R., Butcher, P., & Littlejohns, D. W. (1989). Speech therapy for the psychogenic voice disorder: A survey of current practice and training. *British Journal of Disorders of Communication*, 24, 61-76.
- Erdman, S. (1993). Self-assessment in audiology: The clinical rationale. *Seminars in Hearing*, 14, 30-50.
- Fawcus, M. (1986). *Voice disorders and their management*. London: Croom Helm.
- Fex, F., Fex, S., Shiromoto, O., & Hirano, M. (1994). Acoustic analysis of functional dysphonia: Before and after voice therapy (Accent Method). *Journal of Voice*, 8, 163-167.

- Fisher, H. B., & Logemann, J. A. (1970). Objective evaluation of therapy for vocal nodules: A case report. *Journal of Speech and Hearing Disorders*, 35, 277-285.
- Fitzgerald, F., Murdoch, B., & Cherney, H. (1987). Multiple sclerosis: Associated speech and language disorders. *Australian Journal of Human Communication Disorders*, 15, 15-33.
- Flynn, P. T. (1983). Speech-language pathologists and primary prevention: From idea to action. *Language, Speech, and Hearing Services in Schools*, 14, 99-104.
- Ford, C. N., & Bless, D. M. (1992). *Phonosurgery: Assessment and surgical management*. New York: Raven Press.
- Friedhoff, A. J., Alpert, M., & Kurtzberg, R. L. (1962). An effect of emotion on voice. *Nature*, 193, 357-358.
- Froeschels, E. (1952). The chewing method as therapy. *Archives of Otolaryngology*, 56, 437-434.
- Froeschels, E., Kastein, S., & Weiss, D. A. (1955). A method of therapy for paralytic conditions of the mechanism of phonation, respiration and glutination. *Journal of Speech and Hearing Disorders*, 20, 365-370.
- Gibson, D. L., Weiss, D. J., Dawis, R. V. & Lofquist, L. H. (1970). Manual for the Minnesota Satisfactoriness Scales. *Minnesota Studies in Vocational Rehabilitation*, 27.
- Gould, W., Sataloff R., & Spiegel, J. (1993). *Voice surgery*. Chicago: Mosby Year Book.
- Green, M. C., & Mathieson, L. (1989). *The voice and its disorders*. San Diego: Singular Publishing Group.
- Hammarberg, B. (1984). Pitch and quality characteristics of mutational voice disorders before and after therapy. *Folia Phoniatica*, 39, 204-216.
- Harrison, G., Davis, P., Troughear, R., & Winkworth, A. (1992). Inspiratory speech as a management option for spastic dysphonia. *Annals of Otorhinolaryngology*, 101, 375-382.
- Hartman, D. E., Dally, W. W., & Morin, K. N. (1989). A case of superior laryngeal nerve paresis and psychogenic dysphonia. *Journal of Speech and Hearing Disorders*, 54, 526-529.
- Haywood, A., & Simmons, R. (1982). Relaxation groups with dysphonic patients. *Bulletin of College of Speech Therapists*, 359, 1-3.
- Herrington-Hall, B. L., Lee, L., Stemple, J. C., Niemi, K. R., & McHone, M. M. (1988). Descriptions of laryngeal pathologies by age, sex, and occupation in a treatment-seeking sample. *Journal of Speech and Hearing Disorders*, 53, 57-64.
- H'etu, R., Truchman-Gagon, C., & Bilodiaz, S. (1990). Problems of noise in school settings: A review of the literature and the results of an exploratory study. *Journal of Speech Language Pathology and Audiology/ROA*, 14, 31-39.
- Hillman, R., Gress, C., Hargrave, J., Walsh, M., & Bunting, G. (1990). The efficacy of speech and language pathology intervention: Voice disorders. *Seminars in Speech and Language*, 11, 297-309.
- Hoehn, M., & Yahr, M. (1967). Parkinsonism: Onset, progression, and mortality. *Neurology*, 17, 427.
- Holbrook, A., Rolnick, M., & Bally, C. W. (1974). Treatment of vocal abuse disorders using a vocal intensity controller. *Journal of Speech and Hearing Disorders*, 39, 298-303.

- Holinger, P.H., & Johnson K. C. (1960). Contact ulcer of the larynx. *Journal of the American Medical Association*, 172, 511-555.
- Horsley, I. (1982). Hyponosis and self-hyponosis in the treatment of psychogenic dysphonia. *American Journal of Clinical Hypnosis* 24, 277-283.
- Hull, F. M., Mielke, P. W., Willeford, J. A., & Timmons, R. J. (1976). National speech and hearing survey: Final report (Project 50978). Washington, DC: Bureau of Education for the Handicapped, Office of Education, Department of Health, Education, and Welfare.
- Izdebski, K., Dedo, H., & Boles, L. (1984). Spastic dysphonia: A patient profile of 200 cases. *American Journal of Otolaryngology*, 5, 7-14.
- Johnson, T. S. (1995). *Vocal abuse reduction program*. New York: Taylor & Francis.
- Johnson, T. S. (1985). Voice disorders: The measurement of clinical progress. In J. Costello (Ed.), *Speech disorders in adults: Recent advances* (pp. 127-154). Boston: College Hill Press.
- Johnson, T. S., & Parrish, M. L. (1971). A behavior management approach to vocal nodules in children II. Report of cases. *Feedback*, 4, 11-12.
- Johnson, J. A., & Pring, T. R. (1990). Speech therapy in Parkinson disease: A review and further data. *British Journal of Disorders of Communication*, 25(2), 183-194.
- Kahane, J. C., & Mayo, R. (1989). The need for aggressive pursuit of healthy childhood voices. *Language, Speech, and Hearing Services in Schools*, 20, 102-107.
- Kaplan, S. (1982). Mutational falsetto. *Journal of the American Academy of Child Psychiatry*, 21, 82-85.
- Kay, N. (1982). Vocal nodules in children: Etiology and management. *Journal of Laryngology and Otology*, 96, 731-736.
- Kazdin, A. (1982). *Single case research designs: Methods for clinical and applied settings*. New York: Oxford University.
- Kotby, M., El-Sady, S., Basiouny, S., Abou-Rass, Y., & Hegazi, M. (1991). Efficacy of the accent method of voice therapy. *Journal of Voice*, 5, 316-320.
- Koufman, J. (1991). The otolaryngologic manifestations of gastroesophageal reflux disease (GERD): A clinical investigation of 225 patients using ambulatory 24-hour pH acid and pepsin in the development of laryngeal injury. *Laryngoscope*, 101, 1-78.
- Koufman, J., & Blalock, P. D. (1982). Classification and approach to patients with functional voice disorders. *Annals of Otorhinolaryngology*. 91, 372-377.
- Koufman, J., & Blalock, P. D. (1988). Vocal fatigue and dysphonia in the professional voice user: Bogart-Bacall syndrome. *Laryngoscope*, 98, 493-498.
- Koufman, J., & Blalock, P. D. (1989). Is voice rest never indicated? *Journal of Voice*, 3, 87-91.
- Koufman, J., & Isaacson, G. (1991). The spectrum of vocal dysfunction. *Otolaryngology Clinics of North America*, 24, 985-988.
- Kratochwill, T., & Levin, J. R. (1992). *Single case research design and analysis: New directions for*

psychology and education. Hillsdale, NJ: Lawrence Erlbaum Associates.

Laguaitte, J. K. (1972). Adult voice screening. *Journal of Speech and Hearing Disorders*, 37, 147-151.

Lancer, J. M. Syder, D., Jones, A. S. & Le Boutillier, A. (1988). The outcome of different management patterns for vocal cord nodules. *Journal of Laryngology and Otology*, 102, 423-427.

Lanwehr, L. P. Wood, R. P., Blager, F. B. & Milgrom, H. (1996). Vocal cord dysfunction mimicking exercise-induced bronchospasm in adolescents. *Pediatrics*, 88, 971-974.

Lass, N. Ruscello, D. Stout, L. & Hoffman, F. (1991). Peer perceptions of normal and voice-disordered children. *Folia Phoniatica*, 43, 29-35.

Leeper, H., Leonard, J., & Iverson, R. (1980). Otorhinolaryngologic screening of children with vocal quality disturbances. *International Journal of Pediatric Otorhinolaryngology*, 2, 123-131.

Leske, M. C. (1981, March). Prevalence estimates of communicative disorders in the U.S.: Speech disorders. *Asha*, 23, 217-225.

Lodge, J., & Yarnall, G. (1981). A case study of vocal volume reduction. *Journal of Speech and Hearing Disorders*, 46, 317-320.

Logemann, J. A., Fisher, H. B., Boshes, B., & Blonsky, E. R. (1978). Frequency and concurrence of vocal tract dysfunctions in the speech of a large sample of Parkinson patients. *Journal of Speech and Hearing Disorders*, 42, 47-57.

Martin, S. (1987). *Working with dysphonia*. Oxon: Winslow Press.

Martin, R. J., Blager, F. B., Gay, M. L., & Wood, R. P. (1987). Paradoxical vocal cord motion in presumed asthmatics. *Seminars of Respiratory Medicine*, 8, 332-337.

Mathieson, L. (1989). Voice treatment: The wider perspective. *Speech Therapy in Practice*, 5, 6-8.

McFarlane, S. (1988). Treatment of benign laryngeal disorders with traditional methods and techniques of voice therapy. *Ear, Nose and Throat Journal*, 67, 425-435.

McFarlane, S., & Watterson, T. (1990). Vocal nodules: Endoscopic study of their variations and treatment. *Seminars in Speech and Language*, 11, 1.

McFarlane, S., Holt-Romero, T. L., Lavorato, A. S., & Warner, L. (1991). Unilateral vocal fold paralysis: Perceived vocal quality following three methods of treatment. *American Journal of Speech-Language Pathology*, 1, 45-48.

McReynolds, L., & Kearns, K. (1983). *Single-subject experimental designs in communication disorders*. Baltimore: University Park Press.

Miller, M. K., & Verdolini, K. (1995). Frequency and risk factors for voice problems in teachers of singing and control subjects. *Journal of Voice*, 9, 348-362.

Milisen, R. (1971). Methods of evaluation and diagnosis of speech disorders. In L. Travis (Ed.), *Handbook of speech pathology and audiology*. Englewood Cliffs, NJ: Prentice Hall. 635-672.

Milutinovic, Z. (1990). Results of vocal therapy for phononeurosis: Behavior approach. *Folia Phoniatica*, 42, 173-177.



- Moore, G. P. (1977). Have the major issues in voice disorders been answered by research in speech science? A 50-year retrospective. *Journal of Speech and Hearing Disorders*, 42, 152-160.
- Moran, M. J., & Pentz, A. L. (1987). Otolaryngologists' opinions of voice therapy for vocal nodules in children. *Language, Speech, and Hearing Services in Schools*, 18, 172-178.
- Morrison, M., & Rammage, L. (1994). *The management of voice disorders*. San diego: Singular Publishing Group, Inc.
- Mueller, P. B., & Larson, G. W. (1993). Voice therapy practices and techniques: A survey of voice clinicians. *Journal of Communication Disorders*, 25, 251-260.
- Murry, T., & Woodson, G. (1992). Comparison of three methods for the management of vocal fold nodules. *Journal of Voice*, 6, 271-276.
- Murry, T., & Woodson, G. (1995). Combined modality treatment of adductor spasmodic dysphonia with botulium toxin and voice therapy. *Journal of Voice*, 9, 460-465.
- National Center for Voice and Speech. (1993). *Occupation and voice data*.
- Newman, K. B., & Dubester, S. N. (1994). Vocal cord dysfunction: Masquerader of asthma. *Seminars in Respiratory Critical Care Medicine*, 15, 161-167.
- Nilson, H., & Schneidermann, C. (1983). Classroom program for the prevention of vocal abuse and hoarseness in elementary school children. *Language, Speech, and Hearing Services in Schools*, 14, 121-127.
- Olswang, L. B. (1990). Treatment efficacy: The breadth of research. In L. B. Olswang, C. K. Thompson, S. F. Warren, & N.J. Minghetti (Eds.), *Treatment efficacy research in communication disorders*. Rockville, MD: American Speech-Language-Hearing Foundation.
- Pahn, J. (1966). Zur entwicklung und behandlung funktioneller signstimmerkrankungen [The development and treatment of functional disorders of the singing voice]. *Folia Phoniatica*, 18, 117-130.
- Pannbacker, M. (1975). Comment concerning "incidence of chronic hoarseness among school-aged children." *Journal of Speech and Hearing Disorders*, 40, 548-549.
- Peacher, G. (1947). Contact ulcer of the larynx IV: A clinical study of vocal re-education. *Journal of Speech Disorders*, 12, 179-190.
- Peacher, G. M. (1961). Vocal therapy for contact ulcer of the larynx: A follow-up of 70 patients. *Laryngoscope*, 71, 37-47.
- Peacher, G. M., & Hollinger, P. (1947). Contact ulcer of the larynx: The role of vocal rehabilitation. *Archives of Otolaryngology*, 46, 617-623.
- Perkins, W. H. (1983). *Current therapy of voice disorders*. New York: Thieme Stratton.
- Perkins, W. H. (1985). Assessment and treatment of voice disorders: state of the art. In J. Costello (Ed.), *Speech disorders in adults* (pp. 79-112). San Diego: College Hill.
- Prater, R. J., & Swift, R. W. (1987). *Manual of voice therapy*. Boston: Little Brown.
- Prosek, R., Montgomery, A., Walden, B., & Schwartz, D. (1978). EMG biofeedback in the treatment of

hyperfunctional voice disorders. *Journal of Speech and Hearing Disorders*, 43, 282-294.

Ramig, L. (1995). Voice therapy for neurological disease. *Current Opinion in Otolaryngology, Head and Neck Surgery* 3, 174-182.

Ramig, L. (1996). Neurological disorders of the voice. In W. Brown, B. Vinson, & M. Crary (Eds.), *Organic voice disorders*. San Diego: Singular Publishing Group, Inc.

Ramig, L., Bonitati, C., Lemke, J., & Horii, Y. (1994). Voice treatment for patients with Parkinson disease: Development of an approach and preliminary efficacy data. *Journal of Medical Speech Language Pathology*, 2(3), 191-209.

Ramig, L., Countryman, S., O'Brien, C., Hoehn, M., & Thompson, L. (1996). Intensive speech treatment for patients with Parkinson disease: Short- and long-term comparison of two techniques. *Neurology*, 47, 1496-1504.

Ramig, L., Countryman, S., Thompson, L., & Horii, Y. (1995). A comparison of two forms of intensive speech treatment for Parkinson disease. *Journal of Speech and Hearing Research*, 38, 1232-1251.

Ramig, L., & Dromey, C. (1996). Aerodynamic mechanisms underlying treatment-related changes in SPL in patients with Parkinson disease. *Journal of Speech and Hearing Research*, 39, 798-807.

Ramig, L., Pawlas, A., & Countryman, S. (1995). *The Lee Silverman Voice Treatment: A practical guide for treating the voice and speech disorders in Parkinson disease*. Iowa City: National Center for Voice and Speech, University of Iowa.

Ramig, L., & Scherer, R. (1992). Speech therapy for neurologic disorders of the larynx. In A. Blitzer, M. Brin, C. Sasaki, S. Fahn, & K. Harris (Eds.), *Neurologic disorders of the larynx* (pp. 163-181). New York: Thieme.

Ramig, L. O. (1992). The role of phonation in speech intelligibility: A review and preliminary data from patients with Parkinson's disease. In R. Kent (Ed.), *Intelligibility in speech disorders* (pp. 119-155). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Ramig, L. O., & Verdolini, K. (1997). The efficacy of voice treatment. *Current Opinion in Otolaryngology*, 5, 153-160.

Reed, C. (1980). Voice therapy: A need for research. *Journal of Speech and Hearing Disorders*, 45, 157-169.

Reich, A., McHenry, M., & Keaton, A. (1986). A survey of dysphonic episodes in high-school cheerleaders. *Language, Speech, and Hearing Services in Schools*, 17, 63-71.

Robertson, S., & Thompson, F. (1984). Speech therapy in Parkinson's disease: A study of the efficacy and long-term effect of intensive treatment. *British Journal of Disorders of Communication*, 19, 213-224.

Roy, N., Bless, D., Heisey, D., & Ford, C. (in press). Manual circumlaryngeal therapy for functional dysphonia: An evaluation of short- and long-term treatment outcomes. *Journal of Voice*.

Roy, N., & Leeper, H. A. (1993). Effects of manual laryngeal musculoskeletal tension reduction technique as a treatment for functional voice disorders: Perceptual and acoustic measures. *Journal of Voice*, 7(3), 242-249.

Roy, N., McGrory, J. J., Tasko, S. M., Bless, D. M., Heisey, D., & Ford, C. N. (1997). Psychological correlates of functional dysphonia: An investigation using the Minnesota Multiphasic Personality Inventory. *Journal of Voice*, 11, 443-451.

Rubin, J., Sataloff, R., Korovin, G., & Gould, W. (1995). *Diagnosis and treatment of voice disorders*. New York: Igaku-shoin.

Ruscello, D., Lass, N., & Podbesek, J. (1988). Listener's perceptions of normal and voice-disordered children. *Folia phoniatrica*, 40, 290-296.

Sabol, J. W., Lee, L. & Stemple, J. (1995). The value of vocal function exercises in the practice regimen of singers. *Journal of Voice*, 9, 27-36.

Sanders, E. K. (1989). Arguments against the aggressive pursuit of voice therapy for children. *Language, Speech, and Hearing Services in Schools*, 20, 94-101.

Sapir, S. (1993). Vocal attrition in voice students: Survey findings. *Journal of Voice*, 7, 69-74.

Sapir, S. (1995). Psychogenic spasmodic dysphonia: A case study with expert opinions. *Journal of Voice*, 9, 270-281.

Sapir, S., Atias, J., & Shahar, A. (1990). Symptoms of vocal attrition in women army instructors and new recruits: Results from a survey. *Laryngoscope*, 100, 991-999.

Sapir, S., Keidar, A., & Marthers-Schmidt, B. (1993). Vocal attrition in teachers: survey findings. *European Journal of Disorders of Communication*, 27, 129-135.

Sataloff, R. T. (1991). *Professional Voice: The science and art of clinical care*. New York: Raven Press.

Scheerer, W. (1972). Diagnosis and treatment of voice disorders in school children. *Journal of Speech and Hearing Disorders*, 37, 215-221.

Schiavetti, N., & Metz, D. E. (1997). *Evaluating research in communicative disorders*. Boston: Allyn and Bacon.

Scott, S., & Caird, F. L. (1983). Speech therapy for Parkinson's disease. *Journal of Neurology, Neurosurgery and Psychiatry*, 46, 140-144.

Senturia, B. H., & Wilson, F. B. (1968). Otorhinolaryngologic findings in children with voice deviation. Preliminary report. *Annals of Otology, Rhinology, and Laryngology*, 77, 1027-1042.

Shindo, M. L., & Hanson, D. G. (1990). Geriatric voice and laryngeal dysfunction. *Head and Neck Diseases in the Elderly*, 23, 1035-1044.

Silverman, E. M., & Zimmer, C. H. (1975). Incidence of chronic hoarseness among school-aged children. *Journal of Speech and Hearing Disorders*, 40, 211-215.

Smith, M., & Ramig, L. (1995). Neurological disorders and the voice. In J. Rubin, R. Sataloff, Korovin, G., & Gould, W. (Eds.), *Diagnosis and treatment of voice disorders* (pp. 203-224). New York: Igaku-shoin.

Smith, M., Ramig, L., Dromey, C., Perez, K., & Samandari, R. (1995). Videolaryngoscopy in Parkinson's disease following intensive voice treatment. *Journal of Voice*, 9, 453-459.

Smith, S., & Thyme, K. (1976). Statistic research on changes in speech due to pedagogic treatment (the accent method). *Folia Phoniatrica*, 28, 98-103.

Smith, E., Verdolini, K., Gray, S., Nichols, S., Lemke, J., Barkmeier, J., Dove, H., & Hoffman, H. (1996). Effect of voice disorders on quality of life. *Journal of Medical Speech Language Pathology*, 4, 223-244.

- Stemple, J. (1993). *Voice therapy clinical studies*. St. Louis: Mosby Year Book.
- Stemple, J., Glaze, L., & Gerdemann, B. (1995). *Clinical voice pathology: Theory and management* (2nd ed.). San Diego: Singular Publishing Group.
- Stemple, J. C., Lee, L., D'Amico, B., & Pickup, B. (1994). Efficacy of vocal function exercises as a method of improving voice production. *Journal of Voice*, 83, 271-278.
- Stemple, G. J., Weller, E., Whitehead, W., & Komray, R. (1980). EMG biofeedback training with patients exhibiting a hyperfunctional voice disorder. *Laryngoscope*, 90, 471-476.
- Strandberg, T. E., Griffith, J., & Hollowell, M. W. (1971). A case study of psychogenic hoarseness. *Journal of Speech and Hearing Disorders*, 36, 281-286.
- Titze, I. (1994). *Principles of voice production*. Englewood Cliffs, NJ: Prentice Hall.
- Toohil, R. J. (1975). The psychosomatic aspect of children with vocal nodules. *Archives of Otolaryngology*, 101, 591-595.
- Verdolini, K., Ramig, L., & Jacobson, B. (1997). Voice disorders. In C. Frattali (Ed.), *Outcomes measurement in speech-language pathology* (pp. 354-386). New York: Thieme Medical Publishers.
- Verdolini-Marston, K., Sandage, M. & Titze, I. (1994). Effect of hydration treatments on laryngeal nodules and polyps and related voice measures. *Journal of Voice*, 8, 30-47.
- Verdolini-Marston, K., Burke, M., Lessac, A., Glaze, L., & Caldwell, E. (1995). Preliminary study of two methods of treatment for laryngeal nodules. *Journal of Voice*, 9, 74-85.
- Ward, P., Colton, R., McConnell, F., Malmgren, L., Kashima, H., & Woodson, G. (1989). Aging of the voice and swallowing: Invitational geriatric otorhinolaryngology workshop. *Otolaryngology Head and Neck Surgery*, 100, 286-293.
- Watterson, T., Hansen-Magorian, H., & McFarlane, S.C. (1990). A demographic description of laryngeal contact ulcer patients. *Journal of Voice*, 4, 71-75.
- White, F. (1946). Some causes of hoarseness in children. *Annals of Otology, Rhinology, Laryngology*, 55, 537-542.
- White, E., & Verdolini, K. (1998). Epidemiological study of hoarseness and treatment seeking in African American gospel singers and caucasian classical singers. Manuscript in preparation.
- Wilson, F. (1972). The voice-disordered child: A descriptive approach. *Language, Speech, and Hearing Services in Schools*, 4, 14-22.
- Wilson, D. (1987). *Voice problems of children*. Baltimore: Williams and Wilkins.
- Winer, B. (1971). *Statistical principles in research design*. New York: McGraw Hill.
- Wolski, W., & Wiley, J. (1965). Functional aphonia in a fourteen-year-old boy: A case report. *Journal of Speech and Hearing Disorders*, 30, 71-75.
- World Health Organization. (1987). *International classification of impairments, disabilities and handicaps*. Geneva, Switzerland: Author.

Yairi, E., Currin, L. H., Bulian, N., & Yairi, J. (1974). Incidence of hoarseness in school children over a 1 year period. *Journal of Communication Disorders*, 7, 321-328.

Yamaguchi, H., Yotsukara, Y., Hirosaku, S., Watanabe, Y., Hirose, H., Kobayashi, N., & Bless, D. (1993). Pushing exercise program to correct glottal incompetence. *Journal of Voice*, 7(3), 250-256.

Yamaguchi, H., Yotsukura, Y., Konda, R., Hanyuu, Y., Horiguchi, S., Imaizumi, S., & Hirose, H. (1986). Nonsurgical therapy for vocal nodules. *Folia Phoniatica*, 38, 372-373.

Yorkston, K. (1996). Treatment efficacy: Dysarthria. *Journal of Speech and Hearing Research*, 39, S46-S57.

Zwitman, D. H., & Calcaterra, T. C. (1973). The "silent cough" method for vocal hyperfunction. *Journal of Speech and Hearing Disorders*, 38(1), 119-125.

Contact author: Lorraine Olson Ramig, PhD, Wilbur James Gould Voice Research Center, Denver Center for the Performing Arts, 1245 Champa Street, Denver, CO 80204-2104

~~~~~

By Lorraine Olson Ramig and Katherine Verdolini

Lorraine Olson Ramig, University of Colorado-Boulder and Wilbur James Gould Voice Research Center, Denver Center for the Performing Arts, Denver, C

Katherine Verdolini, Harvard Medical School, Boston, MA and Beth Israel Deaconess Medical Center and Brigham and Woman's Hospital, Boston, MA and Massachusetts General Hospital Institute of Health Professions, Boston, MA

---

Copyright of **Journal of Speech, Language & Hearing Research** is the property of American Speech-Language-Hearing Association. The copyright in an individual article may be maintained by the author in certain cases. Content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.

**Source:** *Journal of Speech, Language & Hearing Research*, Feb98, Vol. 41 Issue 1, pS101, 16p

**Item:** 247155