



Voice Treatment Techniques: A Review and Recommendations for Outcome Studies

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Clinicians are confronted with several treatment options for which there are limited data about efficacy. Some voice treatment practices have broad acceptance, whereas others, such as breathing exercises and

optimum pitch, are controversial. This paper reviews what is currently known about the efficacy of voice treatment and makes recommendations for future studies of voice treatment outcomes and efficacy.

Many voice treatment techniques have been described for use with a variety of disorders (Aronson, 1990; Boone & McFarlane, 1988; Case, 1991; Colton & Casper, 1996; Prater & Swift, 1984; Stemple, 1984; Wilson, 1987). Some techniques are specific, and some are loosely organized principles; others are eclectic, using a combination of strategies. Unfortunately, speech-language pathologists have limited guidance about the value of these treatment approaches.

This lack of information is primarily related to: (a) limited evidence to support or to reject the effectiveness of voice treatment and (b) a confusing mix of data and opinion in much of what has been reported (Blood, 1994; Hillman, Gress, Haugraf, Walsh, & Bunting, 1990; Reed, 1980; Yamaguchi et al., 1993). For example, Andrews (1991) stated that voice treatment techniques described by Andrews and Summers (1991a), Berry (1991), Burk and Brenner (1991), Haskell (1991), and Saniga and Carlin (1991) “have been used successfully,” although there are no empirical data about the effectiveness of these techniques. Such treatment outcomes have been referred to as “expert opinion” or “As I do it” (Verdolini, Ramig, & Jacobson, 1998, pp. 354, 371).

Much of what is known about the efficacy of voice treatment is based on judgments by parents, clinicians, and otolaryngologists. In a survey of a 10-year public school voice program, Madison, Meadors, and Miller (1984) reported that 45% of the parents felt their children’s voices improved with treatment. Moran and Pentz (1987) found that most otolaryngologists have a positive opinion about voice treatment for children with vocal nodules. More recently, Allen, Pettit, and Sherblom (1991) surveyed otolaryngologists and speech-language pathologists about the treatment of vocal nodules in children and adults. The majority (87%) of the two groups believed that voice

treatment can frequently be effective in preventing recurrence of vocal nodules.

Some surveys have identified commonly used treatment techniques (Elias, Raven, Butcher, & Littlejohns, 1989; Larson & Mueller, 1992; Madison et al., 1984; Mueller & Larson, 1992; Shearer, 1972). Elias and associates (1989) surveyed 244 speech-language pathologists in the United Kingdom. Relaxation and voice exercises were the treatment techniques used most frequently for voice disorders. Shearer (1972) reported that “preference for the most effective approach varied according to the clinician” (p. 220). Some clinicians preferred using music, singing, and humming; others preferred relaxation; and still others used Froeschels’ chewing method for treatment of voice problems. In a survey of seven speech clinicians, Madison and associates (1984) found that identification and elimination of vocal abuses was the preferred treatment approach for children with voice problems.

Two published surveys (Larson & Mueller, 1992; Mueller & Larson, 1992) identified reduction of vocal abuse and hard glottal attack, counseling, and relaxation techniques as the preferred voice treatment approaches for both children and adults. Table 1 shows the rankings as reported in Larson and Mueller’s (1992) survey of 66 Professional Service Board accredited clinical programs. Similar results were reported by Mueller and Larson (1992) for 146 members of ASHA’s Voice and Voice Disorders Special Interest Division. Despite the widespread use of these techniques, limited data are available about their effectiveness.

The National Center for Voice and Speech (1994) indicated seven voice treatment methods were commonly used by speech-language pathologists: confidential voice, resonant voice, flow mode, accent, vocal function exercises, Lee Silverman Voice Treatment (LSVT), and

TABLE 1. Preference rankings of voice treatment approaches used by speech-language pathologists.

Approach	Rank
Counseling	1
Vocal abuse elimination	2
Hard glottal attack elimination	3
Relaxation	4
Changing loudness	5
Pushing	6
Yawn-sigh	7
Ear training	8
Establishing new pitch	9
Digital manipulation	10

Note. Adopted from "A national survey of voice therapy practices and techniques" by G. W. Larson and P. B. Mueller, 1992. *Texas Journal of Audiology and Speech Pathology*, 18, pp. 14–16.

facilitating techniques, such as digital manipulation and yawn-sigh.

At present, the type of voice treatment depends on diagnostic category, client characteristics, and the clinician's preference(s) (Verdolini-Marston, Burke, Lessac, Glaze, & Caldwell, 1995). Clinicians are confronted with several treatment options for which there are limited data about efficacy. Clinical practice should be guided by data about outcome; it should be based on what is proven, not on what is popular. This paper reviews what is currently known about voice treatment techniques and discusses issues of voice treatment outcomes and efficacy.

Review of Voice Treatment Techniques and Outcomes

Summaries of the 49 treatment efficacy studies for voice problems published between 1965 and 1998 are listed in Table 2. From 1965 to 1989, only 16 studies were published. There were many years in which no studies about the efficacy of voice treatment were published. Specifically, these years were 1966–1969, 1971–1975, 1977–1978, 1980–1981, 1985–1987, and 1989. The number of studies published increased sharply in the 1990s; 33 studies were published. The largest outlet for research about voice treatment is the *Journal of Voice*.

Accent Method

The accent method is based on accentuated, rhythmic, speech production in association with abdominal-diaphragmatic breathing. This eclectic method for voice treatment has been used for both voice and fluency disorders. It is designed to: (a) increase pulmonary output, (b) reduce glottic waste, (c) reduce excessive muscular tension, and (d) normalize the vibratory pattern during phonation (Koschke, 1993). In this method, development of abdominal-diaphragmatic breathing and accentuated rhythmic vocal play are emphasized. The National Center for Voice and Speech (1994) described the specific training hierarchy as including "work on physiological abdominal

movements to facilitate airflow during phonation. Sound is subsequently superimposed as gentle pulses. Learners are then encouraged to become aware of the abdominal movements and a sense of alternating "release" and contraction. Following these initial training phases, utterances are then produced rhythmically on /hu/. There is an emphasis on whole body movements to avoid developing new tensions. The program continues with nursery rhymes or similar rhythmic material and finally, to conversational speech" (p. 8). Smith and Thyme (1976) reported that the accent method was effective in increasing vocal intensity, frequency range, and general intelligibility. Effectiveness of this method also has been investigated by Kotby, Shiromoto, and Hirano (1993), Fex, Fex, Shiromoto, and Hirano (1994), and Leddy, Samlan, and Poburka (1997).

In a study of three healthy subjects with no history of voice problems, Kotby and associates (1993) found that accent method exercises accentuated abdominal diaphragmatic breathing, raised fundamental frequency, and increased air flow rates and sound pressure level. These results suggested that the accent method was effective in increasing airflow across the glottis, which is considered to be important in modifying vocal fold function.

Fex and associates (1994) treated 10 clients with functional voice disorders using the accent method. Acoustical measures of pitch perturbation quotient, amplitude perturbation quotient, normalized noise energy for 1–4 kHz, and fundamental frequency showed significant improvement following treatment.

Leddy and associates (1997) treated three clients with hyperfunctional voice problems and vocal nodules with the accent method of treatment. All three clients reported favorable outcome on questionnaires developed by the American Speech-Language-Hearing Association (1995, 1997).

Confidential Voice

This treatment technique was described by Colton and Casper (1996) as using the softest intensity one can produce, much like the voice used to exchange a confidence with a friend when one does not wish others to hear. Verdolini-Marston and associates (1995) compared confidential and resonant voice treatment (see below) for 13 women with vocal nodules. There was evidence of benefit from treatment when pre- and posttreatment measures of auditory perceptual status, phonatory effort, and laryngeal appearance were compared with those of subjects who received no treatment (control group). The results suggested that compliance factors affected the outcome of treatment but not treatment type (confidential vs. resonant voice treatment). Leddy and associates (1997) used confidential voice treatment for three clients with hyperfunctional voice problems and vocal nodules. All three clients reported improvement.

Digital Manipulation

Boone and McFarlane (1988) believe that digital manipulation of the larynx can be effective in reducing

TABLE 2 (part 1 of 5). Summary of treatment efficacy studies for voice problems (1965–1998).

Study	N	Disorder Treated	Type of Treatment	Duration of Treatment	Measures	Findings
Aaron & Madison (1991)	36 cheerleaders (females, 16–18)	high risk for voice problems	vocal hygiene	2 1/2-hour sessions per week for 2 weeks	pre- & posttest scores	Significant improvement in pre- vs. posttest scores.
Andersson & Schalen (1998)	30 adults (25 women, 5 men)	psychogenic voice disorders	vocal exercises, communication skill training	maximum 5 45-minute sessions	client report	91.7% satisfied with treatment; 88% no relapses.
Blager, Gray, & Wood (1988)	4 women	chronic cough	voice treatment & psychotherapy	unspecified	patient report/retrospective chart review	Three reported significant improvement.
Blood (1994)	2 women	vocal nodules	computer-assisted voice treatment protocol; relaxation	17–21 sessions	subjective (perceptual) & objective (fundamental frequency maximum phonation time, perturbation factor %, breathing errors, slow rise in volume), laryngoscopy	Effective for reduction of hyperfunctional voice disorders—improved voice, elimination of nodules; relaxation—no substantive changes.
Boone & McFarlane (1993)	8 normal adults (3 women, 5 men)	no history of laryngeal disease or voice problem	yawn-sigh		acoustic & endoscopic	Marked lowering of 2nd & 3rd formats; retracted tongue elevation, lower positioning of larynx, & widened pharynx.
Bridger & Epstein (1983)	109 adults (74 women, 35 men)	functional voice disorders	unspecified	unspecified	retrospective chart review	56% cured (voice returned to pre-morbid state); 26% improved, 6% no improvement, 12% lost to follow-up.
Carding & Horsley (1992)	30 adults (23 women, 7 men)	non-organic dysphonia	no treatment, indirect treatment, direct treatment	8 weeks	perceptual, electrolaryngography, acoustic, patient report, laryngoscopy	Direct treatment group showed most improvement, 9 of 10 normal voice after treatment, 1 patient showed improvement without intervention.
Chan (1994)	experimental group—12 kindergarten teachers control group—13 teachers (women)	prevention	vocal hygiene	2 months	acoustic, electroglottography	Experimental—significant voice improvement instrumentally. Control group—no significant voice change.
Cook, Palaski, & Hanson (1979)	38 children (16 girls, 22 boys)	hoarseness	vocal hygiene	2 1/2-hour sessions per week for 3 weeks	test of vocal hygiene concepts	Learned vocal hygiene concepts.
Deal, McClain, & Sudderth (1976)	31 children (12 girls, 19 boys)	nodules	reduce talking & laryngeal tensing, auditory monitoring	2–3 30-minute sessions per week	laryngeal appearance	After 2 months of voice treatment, 21 (68%) reduced nodule size, 7 (23%) normal larynges. After 6 months of treatment, 26 (64%) reduced nodule size, 27 (65%) normal larynges.

TABLE 2 (part 2 of 5). Summary of treatment efficacy studies for voice problems (1965–1998).

Study	N	Disorder Treated	Type of Treatment	Duration of Treatment	Measures	Findings
Drudge & Phillips (1976)	3 adults	vocal nodules & hoarseness	shaping through successive approximation	16 1/2-hour sessions over 8 weeks	perceptual & laryngoscopic	Improved voice quality & vocal fold condition.
Fex, Shiromoto, & Hirano (1994)	10 adults (8 women, 2 men)	functional voice disorders	accent method	10 30-minute sessions over 4–10 weeks	acoustic analysis	Normalized noise energy for 1–4 kHz & fundamental frequency significant improvement.
Fisher & Logemann (1970)	1 woman	nodules	habituation of higher pitch	unspecified	laryngoscopy with photographs	Increased open quotient & reduced speed quotient. Marked reduction in nodules.
Glaze (1996)	1 7-year-old girl	nodules with hoarseness	identification & elimination of vocal abuses, vocal exercises	7 sessions over 3 months	videostroboscopic, acoustic, aerodynamic, perceptual	Positive outcome all measures.
Gordon, Pearson, Paton, & Montgomery (1997)	200	dysphonia from vocal misuse or abuse	unspecified but included relaxation	2 years	respiration & air flow	Variable
Gray, England, & Mohoney (1965)	1 woman	vocal nodules	reciprocal inhibition	15 1/2-hour sessions for 3 weeks	laryngoscopy, subjective	Nodules reduced, tension reduced.
Hufnagle & Hufnagle (1984)	8 women	vocal nodules	modified Wilson & Rice program	unspecified	acoustic & perceptual	No significant change in speaking fundamental frequency with voice improvement; treatment for dysphonia associated with nodules is best managed by procedures other than manipulating pitch & thus changing speaking fundamental frequency.
Kitzing & Akerlund (1993)	174 adults (114 women, 60 men)	non-organic voice disorders	voice treatment	14–22 sessions	acoustic & perceptual	Spectra from unchanged voices (33) very similar to those before treatment. Spectra from improved voices (28) general increase in level of all selected frequency ranges.
Kotby, Shiromoto, & Hirano (1993)	3	no history of voice problems	accent method	unspecified	acoustic, airflow	Effective, improved fundamental frequency, sound pressure level, airflow.
Koufman & Bialock (1982)	52 6- to 76-year-olds (39 females, 13 males)	functional voice disorder	unspecified voice treatment	unspecified	follow-up examination	Variable
Koufman & Bialock (1988)	67 adult, professional voice users (41 women, 26 men)	dysphonia, musculoskeletal tension disorders of larynx	reassurance, remedial, patient education	unspecified	perceptual, acoustic, musculoskeletal tension (subjective); laryngoscopy	71% symptoms completely resolved, 17% occasional relapses, 6% frequent relapses, 6% persistent symptoms.

TABLE 2 (part 3 of 5). Summary of treatment efficacy studies for voice problems (1965–1998).

Study	N	Disorder Treated	Type of Treatment	Duration of Treatment	Measures	Findings
Lancer, Syder, Jones, & Le Boutillier (1988)	20 adults (13 women, 7 men)	vocal nodules	relaxation, vocal rest, elimination of vocal abuses, breathing exercises, reduce volume, improve pitch	unspecified	retrospective chart review & patient questionnaire	No diagnosed recurrence of vocal nodules in patient who has speech treatment, with or without surgery. Five patients who had surgery only had recurrence of nodules.
Leddy, Samlan, & Poburka (1997)	10	vocal nodules	accent, confidantial & resonant	unspecified	patient questionnaires stroboscopy, electroglottography	All patients reported improvement in functional voice use; objective measures not reported.
McFarlane (1988)	9 adults (4 women, 5 men)	benign laryngeal disorders	eclectic	variable	unspecified	Variable
McFarlane, Holt-Romeo, Lavorato, & Warner (1991)	16 adults (9 women, 7 men)	unilateral recurrent laryngeal nerve paralysis	Teflon injection, muscle-nerve reinnervation surgery & voice treatment (head turning, lateral digital manipulation of thyroid, half swallow boom)	variable, 3–24 hours, average 9 hours	perceptual analysis	Voice treatment & muscle-nerve reinnervation more successful than Teflon injection. None recovered vocal fold function.
McFarlane & Watterson (1990)	11 children (3 girls, 8 boys), 33 adults (30 women, 3 men)	vocal nodules	vocal hygiene, abuse reduction, vocal retraining	variable, 5–50 1-1/2 hour sessions, average of 20 sessions.	endoscopy & perceptual	Fewer than 1% experience return of nodules. Voice treatment effective in eliminating nodules & returning voice to normal.
Nickel, Middleton, & Brand (1992)	161 teachers and third graders	prevention	vocal hygiene	2 30-minute sessions on 2 consecutive days	pre- & posttest	Knowledge of vocal hygiene increased & significantly retained.
Nilson & Schneiderman (1983)	155	prevention	vocal hygiene	4 sessions	pre- & posttest	Positive changes in vocal abuse & self-monitoring skills.
Peppard (1996)	3 case studies of adolescents (2 girls, 1 boy)	functional aphonia, puberphonia	voice treatment	not specified	laryngoscopic, videostroboscopy, acoustic, auditory perceptual	Posttreatment measures not reported.
Ramig et al. (1995)	45 adults (12 women, 33 men)	Parkinson disease	LSVT respiratory vs. voice & respiratory treatment	16 sessions for 4 weeks: Intensive	intensity & maximum duration, habitual fundamental frequency, fundamental frequency variability, utterance & pause duration. Family & subject self-rating of voice.	VR treatment more effective than R treatment alone for improving vocal intensity & decreasing impact of Parkinson disease on communication.

TABLE 2 (part 4 of 5). Summary of treatment efficacy studies for voice problems (1965–1998).

Study	N	Disorder Treated	Type of Treatment	Duration of Treatment	Measures	Findings
Ramig & Dromei (1996)	45 adults (12 women, 33 men)	Parkinson disease	LSVT	6 1-hour sessions within 4 weeks	maximum flow declination rising (MFDR) & estimated pressure (P _{suh}), relaxation vocal fold adduction (EGGW), sound pressure level (SPL)	VR treatment more effective
Ramig, Countryman, O'Brian, Hoehn, & Thompson (1996)	35 adults	Parkinson disease	LSVT vs. respiration treatment	16 sessions for 4 weeks	voice intensity	LSVT group maintained improved vocal intensity long term (12 months)
Ramig, Countryman, & Thompson (1995)	45 adults (12 women, 33 men)	Parkinson disease	LSVT or respiration treatment	16 sessions for 4 weeks	SPL, MFDR maximum sustained vowel phonation, subject & family rating	LSVT group more improved
Robertson & Thomson (1984)	12 adult treatment group; 6 adult control group (1 woman, 17 men)	speech & voice problems associated with Parkinson disease	speech-voice treatment	3-1/2 to 4 hours daily, total 35–40 hours for 2 weeks	dysarthria profile	Treatment group improved scores on dysarthria profile
Roy (1993)	1 man	ventricular dysphonia	manual, tension reduction	8 sessions over 2 months	perceptual, acoustic, videolaryngoendoscopic	Significant improvement in voice based on perceptual & acoustic measures; videolaryngoendoscopic confirmed progressive reduction in ventricular-based approximation.
Roy & Leeper (1993)	17 adults (16 women, 1 man)	functional dysphonia	manual musculo-skeletal tension reduction	1 session, ranging from 1 to 3 hours	perceptual & acoustic	Perceptual measures more consistently rated as normal, acoustic measures significant improvement in jitter, shimmer, & signal-to-noise ratio
Schmidt & Andrews (1993)	9 cheerleaders & professional voice users	hyperfunctional voice disorders with & without vocal fold pathology. Musculo-skeletal tension, vocal abuse	tension reduction, increased air flow, relaxed phonation, sustained easy voicing	10 1-hour sessions	consistency in clinician & client behavior	Evaluations & effectiveness of treatment not indicated
Schneider (1993)	1 woman	nodules & dysphonia	vocal hygiene, increased hydration & humidifying, slower speech rate, relaxation	12 weekly sessions; assessment over 2 years	voice quality rankings, vocal fold photographs, acoustic	Voice quality tended to relate to changes in vocal fold pathology and patient report of vocal function

TABLE 2 (part 5 of 5). Summary of treatment efficacy studies for voice problems (1965–1998).

Study	N	Disorder Treated	Type of Treatment	Duration of Treatment	Measures	Findings
Smith et al. (1995)	22 adults (5 women, 17 men)	Parkinson disease	LSVT; respiratory vs. voice & respiratory treatment (R)	16 sessions for 4 weeks: Intensive	fiberoptic, laryngoscopy, rigid telescopic laryngoscopy	VR group improvements laryngoscopy; less glottal incompetence, no change in supra-glottal hyperfunction.
Smith & Thyme (1976)	30	unspecified	accent method	10 consecutive sessions	acoustic	Increased duration of fundamental sounds with energy above 1000 Hz, intensively below 1000 Hz
Stemple, Lee, D'Amico, & Pickup (1994)	35: experimental, control, & placebo groups	no history of voice disorders or laryngeal pathology	vocal function exercises	2 15–20 minute sessions, 7 days per week for 4 weeks	acoustic, aerodynamic, videostroboscopic	Significant changes in experimental group.
Treole & Trudeau (1997)	13 women	vocal nodules	tension reduction, abuse identification & elimination, laryngeal strengthening	6–26 sessions	sustained phonation	Did not demonstrate change over course of treatment.
Trullinger, Emanuel, Skenes, & Malpass (1988)	1 woman	vocal nodules	relaxation, vocal hygiene	3 weeks	perceptual and acoustic analysis, laryngoscopy	Perceived voice quality improved, reduction in vowel SNL, increase in vowel Fo, reduction in vocal nodules.
Verdolini (1997)	1 male	multiple sclerosis	LSVT	16 sessions for 4 weeks	Loudness from 55 to 60–65 dB; intelligibility improved to about 70–80% in many situations	Some benefits but less striking than for Parkinson disease.
Verdolini-Marston & associates (1995)	13 women: control & experimental	vocal nodules	confidential & resonant voice treatment	9 sessions over 12 days	perceptual, phonatory effect, laryngeal appearance; client impressions	Benefit from treatment co-varied with compliance scores (extra clinical) but not with treatment (confidential vs. resonant).
Verdolini-Marston, Sandage, & Titze (1994)	6 women	vocal nodules	double-blind: hydration and placebo	10 consecutive days	perceptual, acoustic, laryngoscopy	Improvements in voice and laryngeal appearance following both placebo/control and hydration but greatest improvement with hydration.
Woo, Casper, Colton, & Brewer (1994)	62 (47 women, 14 men)	persistent dysphonia after laryngeal surgery	voice treatment	6 1-hour sessions	retrospective; laryngoscopy and voice ratings; client impressions	33 of 57 improved; 12 no improvement
Xu, Ikeda, & Komiyama (1991)	91 adults (74 women, 17 men)	vocal nodules, recurrent laryngeal nerve paralysis, chronic laryngitis & sulcus vocals	yawning breath pattern (YBP)	10 20–30 minute sessions	breath pattern, laryngoscopy, perceptual, patient response, breath curve evaluation	Effective about 1/3 mastered YBP and symptoms improved.
Yamaguchi & associates (1993)	3 adults (1 woman, 2 men)	glottal incompetence & dysphonia	pushing exercises	20–30 minutes once a week for 3–7 months	perceptual, acoustic, stroboscopic, & phonolaryngography	Support for efficacy of pushing method.

laryngeal musculoskeletal tension. This technique is outlined in Table 3. Other writers also have recommended this treatment technique for problems of vocal hyperfunction (Aronson, 1990; Case, 1991; Colton & Casper, 1996; Stemple, 1984). Recently, Roy and Leeper (1993) reported the results of manual laryngeal musculoskeletal tension reduction treatment of 17 clients with functional dysphonia of unknown severity. There was a significant change in voice function in the majority of clients within one treatment session. Perceptual measures of voice during speech and vowel prolongation were consistently more likely to be rated as normal following treatment. Acoustic measures of voice confirmed significant improvements in jitter, shimmer, and signal-to-noise ratio. Fourteen of the 17 clients were rated as having near normal voice or only mild dysphonia following treatment. Roy (1993) also reported improvement in perceptual, acoustic, and video-laryngoendoscopic measures of voice production in a 64-year-old male following eight sessions of voice treatment using digital manipulation.

Hydration

These treatments are often used to treat voice disorders including those associated with polyps and vocal nodules. Treatment includes ambient humidification, direct steam inhalation, elevated intake of water or other hydration fluids, mucolytic drug administration, and nose breathing (McFarlane & Watterson, 1990; Sataloff, 1987a, 1987b; Verdolini-Marston, Sandage, & Titze, 1994). Avoidance of drying conditions and agents such as dry environments;

TABLE 3. Instructions for digital manipulation of the laryngeal areas.

- Encircle the hyoid bone with the thumb and middle finger, working them posteriorly until the tips of the major horns are felt.
- Exert light pressure with the fingers in a circular motion over the tips of the hyoid bone and ask if client feels pain, not just pressure. It is important to watch facial expression for signs of pain or discomfort.
- Repeat this procedure with the fingers in the thyrohyoid space, beginning from the thyroid notch and working posteriorly.
- Find the posterior borders of the thyroid cartilage just medial to the sternocleidomastoid muscles and repeat the procedure.
- With the fingers over the superior borders of the thyroid cartilage, begin to work the larynx gently downward, also moving it laterally at times. One should check for a lower laryngeal position by estimating the increased size of the thyrohyoid space.
- Ask the client to prolong vowels during these procedures, noting changes in quality or pitch. Clearer voice quality and lower pitch indicate relief of tension. Because these procedures are fatiguing, rest periods should be provided.
- Once a voice change has taken place, the client should be allowed to experiment with the voice, repeating vowels, words, and sentences.

Note. From *Clinical voice disorders* by A. E. Aronson (1990). New York: Thieme (pp. 314–315).

smoke; alcohol, caffeine, and other diuretics; antihistamines; drying nasal sprays and decongestants, and mouth breathing also may be recommended.

In a double-blind placebo-controlled study of six women with vocal nodules or polyps, Verdolini-Marston and associates (1994) found significant improvement in voice and laryngeal appearance following both placebo (control) and hydration treatments. However, greater improvements were obtained with the hydration treatment.

Lee Silverman Voice Treatment

Lee Silverman Voice Treatment (LSVT) is designed to increase phonatory effort, reduce vocal fold bowing, and improve loudness. It has been used to treat voice problems associated with Parkinson disease and multiple sclerosis, which are progressive neurological diseases. LSVT is an intensive program of treatment consisting of 4 sessions per week for 1 month. The focus of treatment is increasing loudness, maximum phonatory effort, high treatment effort, and voice awareness. Treatment progresses from simpler tasks to more complex speech drills. Fox and Ramig (1997) reported that vocal sound pressure level and self-perception of speech and voice in 30 men and women with Parkinson disease “provide a clear motivation for considering a treatment program designed to increase vocal loudness, such as the LSVT” (p. 91). Smith, Ramig, Dromey, Perez, and Samandari (1995) compared the effectiveness of two types of treatment, one to increase respiratory effort only (R) and LSVT (respiration and phonation) for 45 individuals with Parkinson disease. No improvement was observed in the R-only group, but the LSVT treatment group showed improvement on laryngostroboscopic variables: less glottal incompetence and no significant change in supraglottal hyperfunction. Similar results for these same individuals were reported by Ramig, Countryman, Thompson, and Horii (1995) for acoustic and perceptual measures. Ramig and Dromey (1996) studied treatment-related changes in aerodynamic and glottographic characteristics and found significant change in individuals who received LSVT but did not find changes following R-only treatment. In a review of treatment for dysarthria, Yorkston (1996) agreed that LSVT is effective. Ramig, Countryman, O’Brian, Hoehn, and Thompson (1996) reported data to support the long-term (12 months) effects of LSVT. Recently, Ramig (1997) stated that many clients with Parkinson disease who were treated with LSVT were able to maintain speech improvements for 2 years without additional treatment. Verdolini (1997) described LSVT for a 45-year-old male with multiple sclerosis and dysarthria. The dysarthria was characterized by unintelligibility, “tight and spastic” voice and articulation, and inconsistent hypernasality (p. 34). By the end of the 4-week LSVT program, posttreatment measures indicated some improvement, although the approach seems more effective for Parkinson disease. The degenerative nature of Parkinson disease and multiple sclerosis suggests the need for long-term follow-up to determine effectiveness. According to Hillman and associates (1990), “voice treatment for disorders that are degenerative is controversial since

there is no expectation for recovery of function, or that any improvements secondary to SLP intervention will be maintained in the long term” (p. 308). On the other hand, Johnson and Pring (1990) believe speech-language pathologists should reevaluate their negative attitudes about speech treatment for clients with Parkinson disease.

Pushing

First described by Froeschels in 1943, this method is used to increase glottal closure and thus reduce glottal inefficiency. More recently, Boone and McFarlane (1988), Colton and Casper (1996), and Wilson (1987) described the use of pushing exercises. Pushing activities include pushing down on the chair, pushing against the wall, and the like. These activities facilitate closure of the glottis and a lower-pitched voice (Colton & Casper, 1996). Pushing exercises were used by Yamaguchi and associates (1993) to treat 29 clients with glottal incompetence. Pre- and posttreatment measures based on perceptual and acoustic analysis, stroboscopic examination, and phonolaryngography “support the efficacy of this technique in select cases of glottal incompetence” (p. 256). They warn that overcompensation resulting in hyperfunction should be avoided. In other words, pushing exercises should be used with caution: “patients should be selected carefully and during the course of treatment, monitored for any signs of hyperfunction that could result in additional laryngeal problems” (p. 256). Yamaguchi and associates (1993) indicate other voice treatment approaches may provide equally good, or even better, results than pushing exercises because: (a) complete glottal closure is not always necessary or in some cases even desirable for normal voice, (b) overcompensation could result in undesirable strain and trauma, and (c) pushing is inappropriate for individuals who have vocal fold hemorrhage or adequate closure of the posterior glottis.

Reciprocal Inhibition

In reciprocal inhibition the client is taught relaxed responses to anxiety-evoking situations after identifying a hierarchy from least to most anxiety evoking. The client then begins by using the relaxed responses in the least anxious situation and works his or her way up the hierarchy. Gray, England, and Mohoney (1965) described the use of reciprocal inhibition in the treatment of vocal nodules in an adult woman. Following treatment, laryngeal examination indicated “complete laryngeal recovery,” and the client reported a general reduction in anxiety.

Relaxation

Several authors have commented on the beneficial effects of relaxation for treatment of hyperfunctional voice problems (Boone & McFarlane, 1988; Case, 1991; Colton & Casper, 1996; Prater & Swift, 1984; Stemple, 1984; Wilson, 1987). Blood (1994) described a voice treatment protocol using a computer-assisted biofeedback device for hyperfunctional voice disorders with two women with

vocal nodules. The relaxation component was not associated with clinically significant improvements in voice; “although relaxation may serve as an adjunct to the treatment process, there is no evidence that specific general relaxation techniques were necessary” (p. 64). Blood concluded that “for subjects with environmental stresses, providing basic relaxation training may alleviate stress and complement the overall treatment package” (p. 64). Traditional voice treatment may promote general relaxation because of its typical components of vocal hygiene and counseling about vocal abuse. Gordon, Pearson, Paton, and Montgomery (1997) reported that relaxation resolved dysphonia resulting from vocal misuse or abuse in 69 of 200 (25%) patients.

Resonant Voice Treatment

According to Verdolini-Marston and associates (1995) resonant voice treatment involves vibratory sensation on the alveolar ridge and other facial areas that arises, in part, from an acoustic tuning of the supraglottic cavities to the glottal source spectrum. In this treatment, the focus is on the production of voice with anterior oral vibratory sensations in the context of easy phonation (Verdolini et al., 1998). It is usually produced with relatively complete anterior posterior closure of the vocal folds during phonation. Resonant voice treatment has been used for hyperfunctional and hypofunctional voice problems. This type of treatment is also used in the theater and classical music. Resonant voice treatment was compared to confidential voice treatment for vocal nodules by Verdolini-Marston and associates (1995). The type of treatment was unrelated to outcome, although there was evidence of benefit from treatment when pre- and posttreatment measures were combined for treatment and control subjects. Resonant treatment was used to treat four clients by Leddy and associates (1997). The clients reported the treatment was effective.

Vocal Function Exercises

Vocal function exercises are designed to restore balance, strength, and ease of phonation. The exercises focus on specific muscles identified as weak or hyperactive, or muscle groups as impaired. Pitch glides and sustained high or low pitches may be used for pitch and adduction of related muscles (National Center for Voice and Speech, 1994). Stemple, Lee, D’Amico, and Pickup (1994) studied the efficacy of vocal function exercises in 35 adult women with no history of voice disorders or laryngeal pathology. Subjects were randomly divided into experimental, placebo, and control groups. Treatment consisted of exercises designed to improve laryngeal control. Objective analysis including acoustic, aerodynamic, and videostroboscopic measures indicated significant changes for the experimental group after 4 weeks of vocal function exercises. There were no significant changes in the control and placebo groups. More recently, Andersson and Schalen (1998) reported on 30 clients with psychogenic voice disorders who were treated using a

combination of vocal exercises and training in communication skills. A structured telephone interview was used to determine the results of treatment. During the interview, voice quality was informally evaluated. Most of the clients were satisfied with treatment (91%) and did not report relapses (88%).

Voice training typically includes vocal exercises to lower the larynx because an elevated position of the larynx is frequently associated with functional dysphonia characterized by hyperfunctional and exaggerated vocal fold adduction. Elliot, Sundberg, and Gramming (1997) studied the physiological aspects of vocal exercise for lowering the larynx in seven subjects; two had hyperfunctional dysphonia. A multichannel electroglottograph was used to measure the vertical position of the larynx. The results indicated that vocal exercise caused substantial lowering of the larynx.

Vocal Hygiene

Vocal hygiene is a term first used by Froeschels (1943) for appropriate use of the voice to prevent hyperfunction and excessive laryngeal musculoskeletal tension. Vocal hygiene is based on the assumption that vocal abuse often contributes to voice problems and that elimination or reduction of vocal abuse helps to restore normal voice. Vocal hygiene has become an important part of most voice treatment programs for children and adults (Andrews & Summers, 1991b; Aronson, 1990; Boone & McFarlane, 1988; Case, 1991; Colton & Casper, 1996; Prater & Swift, 1984; Stemple, 1984; Wilson, 1987). However, McNamara and Perry (1994) in a national survey of school-based speech-language pathologists found that more than 80% of the respondents did not have vocal abuse prevention programs primarily because of time constraints and the low incidence of or the low priority assigned to voice problems. Several reports have indicated that vocal hygiene programs are effective for preventing and eliminating vocal abuse as well as improving voice in children and classroom teachers (Aaron & Madison, 1991; Chan, 1994; Cook, Palaski, & Hanson, 1979; McFarlane & Watterson, 1990; Nickel, Middleton, & Brand, 1992; Nilson & Schneiderman, 1983).

Yawn-Sigh

Boone and McFarlane (1988) believe “the yawn-sigh is a powerful voice therapy technique for patients with vocal hyperfunction” (p. 184). The yawn-sigh method is designed to lower the position of the larynx, widen the supraglottal airway, and produce a more relaxed voice. In yawning, the larynx lowers, which reduces excessive laryngeal strain and facilitates easy airflow and phonation. It is often combined with other voice treatment techniques. This technique has been described by Case (1991), Colton and Casper (1996), and Prater and Swift (1984).

The physiologic and acoustic effects of the yawn-sigh technique in eight normal subjects with no history of laryngeal disease or a voice problem were studied by Boone and McFarlane (1993). They found that after the yawn and during the sigh condition, seven of the eight subjects lowered the larynx, retracted and elevated the

tongue, had some pharyngeal widening, and produced a more breathy voice with lowering of the second and third formants. Boone and McFarlane concluded that the yawn-sigh is a useful technique for reducing vocal hyperfunction.

Xu, Ikeda, and Komiyama (1991) used a modification of the yawn-sigh method, the yawning breath pattern (YBP), with 91 clients who had voice problems associated with vocal nodules, recurrent laryngeal nerve paralysis, and incomplete glottal closure. This method involves yawning during exhalation and keeping the diaphragm and lower chest in a sustained extended state. Reportedly “about one-third of the patients mastered the YBP perfectly, and their symptoms improved satisfactorily” (p. 76). The relationship between mastering YBP and laryngeal condition is unknown. The effectiveness of YBP for incomplete glottal closure is difficult to understand because hypofunctional problems typically require techniques to increase glottal closure.

Discussion of Voice Treatment Efficacy

Answers to questions such as “Does voice treatment work?” or “Is one treatment more effective than another?” are at best tentative. Although there is some research to support the effectiveness of the accent method, confidential voice, digital manipulation, LSVT, vocal hygiene, pushing, relaxation, resonant voice, vocal function exercises, and the yawn-sigh technique, essentially no research is available to support or refute some of the other more commonly used techniques to treat voice disorders such as flow mode treatment and ear training. The popularity of these techniques is interesting in view of the paucity of available data. In other words, there is a disparity between popularity and evidence of effectiveness. The studies reviewed here vary relative to the speaker, diagnosis, treatment focus and intensity, study design, and method of reporting outcomes.

Most studies support the value of treatment for voice problems. There are limited data about negative results and no detailed information (Andersson & Schalen, 1998; Blager, Gray, & Wood, 1988; Bridger & Epstein, 1983; Carding & Horsley, 1992; Hufnagle & Hufnagle, 1984; Koufman & Blalock, 1982, 1988; Woo, Casper, Colton, & Brewer, 1994; Xu et al., 1991). It is possible that negative findings tend not to be published because authors chose not to submit negative findings or editors chose not to publish them. Robey (1998) considers this a publication bias or the file-drawer problem. Hufnagle and Hufnagle (1984) found “that therapy for dysphonia associated with nodules is best managed by procedures other than those manipulating pitch” (p. 99). More recently, Woo and associates (1994) reported treatment results for 62 clients with a variety of voice disorders after laryngeal surgery. Twelve clients had no voice improvement, but “excellent voice improvement” was reported for 22 clients.

Speaker Variables

Variables related to speakers are likely to affect the results of treatment for voice disorders. These variables include number of subjects studied, age, and gender.

Number of Subjects. There is considerable variability in numbers of subjects across studies, ranging from 200 (Gordon et al., 1997) to single case studies (Fisher & Logemann, 1970; Glaze, 1996; Gray et al., 1965; Roy, 1993; Schneider, 1993; Trullinger, Emanuel, Skenes, & Malpass, 1988; McFarlane, 1988; Verdolini, 1997).

Twenty-six of the studies had less than 20 subjects.

Age of Subjects. Most studies about the efficacy of voice treatment have been of adults. This is noteworthy because less is known about the frequency of occurrence of voice disorders in adults than in children (Ramig & Verdolini, 1998). Furthermore, age was not reported in some studies (Gordon et al., 1997; Leddy et al., 1997).

Only four studies have focused on children, involving a total of 385 school-age children (Cook et al., 1979; Deal, McClain, & Sudderth, 1976; Nickel et al., 1992; Nilson & Schneiderman, 1983). These studies examined vocal hygiene and treatment of vocal nodules and hoarseness. There is disagreement about treating children for voice problems. Sander (1989) believes in a less aggressive pursuit of voice treatment for children because: (a) childhood vocal nodules usually disappear by puberty, especially among males, and (b) intervention often is either unnecessary or is of no permanent value. Furthermore, Sander suggests vocal hygiene programs “seem harmless enough” but could “if pursued aggressively, instill in children the mistaken conviction that the larynx is a far more fragile instrument than it typically is” and create a population of “phonophobics” (p. 100). On the other hand, Kahane and Mayo (1989) advocate early identification, prevention, and treatment of voice disorders in children. More recently, Andrews (1993) recommends intervention for preadolescents and adolescents engaged in recreational pre-professional or professional voice use. Case studies about treatment of four children and adolescents with voice problems have been reported by Glaze (1996) and Peppard (1996). These case studies described treatment approaches that were effective.

Gender of Subjects. Studies on the prevalence of voice disorders do not usually include data about gender. Dobres, Lee, Stemple, Kummer, and Kretschman (1990) found that laryngeal pathologies were more common in boys, but Herrington-Hall, Lee, Stemple, Niemi, and McHone (1988) found that voice problems and laryngeal pathologies were more common in women.

Of the studies listed in Table 2, more females received treatment for voice problems. Gender was not specified in three studies (Drudge & Philips, 1976; Gordon et al., 1997; Leddy et al., 1997). Only one study examined differential effects of treatment for males and females; the results of treatment were better for females (Koufman & Blalock, 1982). The influence of gender on treatment outcome is largely unknown.

Treatment Methodologies

Difference in clinical outcome studies of voice treatment are related to several factors. These factors include focus of treatment and length and duration of treatment.

Methodology or Focus of Treatment. The focus of

treatment varies greatly from study to study. Some are broadly based voice treatment programs (Blager, Gray & Wood, 1988; Bridger & Epstein, 1983; Carding & Horsley, 1992; Deal et al., 1976; Gordon et al., 1997; Kitzing & Akerlund, 1993; Koufman & Blalock, 1982, 1988; Lancer, Syder, Jones, & Le Boutillier, 1988; McFarlane, 1988; McFarlane, Holt-Romeo, Lavorato, & Warner, 1991; Schmidt & Andrews, 1993; Robertson & Thomson, 1984; Schneider, 1993; Treole & Trudeau, 1997; Trullinger et al., 1988; Woo et al., 1994). Some studies focus on a single type of voice treatment. Studies are reported by principal method of treatment in Table 4. Others do not indicate the type of treatment (Bridger & Epstein, 1983; Carding & Horsley, 1992). Studies of this sort provide no way to determine which aspects of treatment are having an effect.

All of these factors make it difficult for clinicians to determine which clients are most appropriate for a given treatment. Only four studies compared various treatments. Smith and associates (1995) and Ramig and associates (1995, 1996) compared respiration, and voice and respiration (LSVT), treatment for Parkinson disease. LSVT was more effective than respiration-only treatment. Verdolini-Marston and associates (1995) studied the effectiveness of

TABLE 4. Efficacy studies arranged alphabetically by principal treatment and chronologically by year of publication.

Principal Treatment	Author(s)	Year
Accent method	Smith & Thyme	1976
	Kotby et al.	1993
	Fex et al.	1994
Confidential	Verdolini-Marston et al.	1995
Hydration	Verdolini-Marston et al.	1994
Lee Silverman Voice Treatment (LSVT)	Ramig et al.	1995
	Smith et al.	1995
	Ramig & Dromey	1996
	Ramig et al.	1996
	Ramig	1997
Verdolini	1997	
Manual tension reduction	Roy	1993
	Roy & Leeper	1993
Pushing	Yamaguchi et al.	1993
Reciprocal inhibition	Gray et al.	1965
Relaxation	Blood	1994
	Gordon et al.	1997
Resonant	Verdolini-Marston et al.	1995
Vocal function exercises	Stemple et al.	1994
	Andersson & Schalen	1998
Vocal hygiene	Cook, Palaski, & Hanson	1979
	Nilson & Schneiderman	1983
	McFarlane & Watterson	1990
	Aaron & Madison	1991
	Nickel, Middleton, & Brand	1992
	Boone & McFarlane	1993
	Chan	1994
Yawn-sigh	Boone & McFarlane	1993
Yawn breathing pattern (YBP)	Xu et al.	1991

confidential voice versus resonant voice treatment. Results were unrelated to type of treatment. Leddy and associates (1997) compared accent, confidential, and resonant voice treatment for speakers with hyperfunctional voice problems and nodules. Improvement in functional voice use based on patient report was reported for all three methods of treatment.

Length and Duration of Treatment. Few studies provided data about intensity and duration of treatment (Aaron & Madison, 1991; Cook et al., 1979; Gordon et al., 1997; Gray et al., 1965; Nickel et al., 1992; Ramig & Dromey, 1996; Stemple et al., 1994). The inconsistency in reporting intensity of treatment makes it difficult to compare results across studies. In some studies number of sessions was reported, whereas others reported hours, weeks, or months of treatment. The range of the extent of treatment spanned from 4 (Aaron & Madison, 1991), to 51 sessions (McFarlane & Watterson, 1990). Some studies reported length of sessions while many did not (Blood, 1994; Carding & Horsley, 1992; Kitzing & Akerlund, 1993; McFarlane et al., 1991; Ramig et al., 1995; Roy, 1993; Schneider, 1993; Smith et al., 1995; Smith & Thyme, 1976; Treole & Trudeau, 1997; Trullinger et al., 1988; Verdolini-Marston et al., 1994, 1995). The range of duration of treatment sessions was from 30 minutes to 3-1/2 or 4 hours (Robertson & Thomson, 1984). Furthermore, intensity of treatment varied from concentrated periods of intervention (e.g., five sessions for 5 consecutive days) (Verdolini-Marston et al., 1994) to extended periods of less intensive treatment (3 to 7 months) (Yamaguchi et al., 1993). Several of the studies did not report information about the duration of treatment (Blager et al., 1988; Bridger & Epstein, 1983; Fisher & Logemann, 1970; Hufnagle & Hufnagle, 1984; Kotby et al., 1993; Koufman & Blalock, 1982, 1988; Lancer et al., 1988).

There are great differences across studies and clients in the average treatment time reported for adults with vocal fold paralysis. McFarlane and associates (1991) reported that adults with vocal fold paralysis required a mean of 9 hours treatment with a range of 3 to 24 hours. Larson and Mueller (1992) reported that adults with vocal fold paralysis required longer treatment times, specifically a mean of 17.5 and range of 5 to 40 hours.

Diagnostic Condition

The etiologies of the voice problems treated were heterogeneous and included vocal nodules, functional voice problems, laryngeal nerve paralysis, Parkinson disease, and multiple sclerosis (see Table 2). It is possible that voice treatment does not produce similar results for different etiologies. As yet, the extent to which etiology influences the effectiveness of voice treatment is unknown, although Colton and Casper (1996) believe "recognition of the correct etiology is essential for proper treatment" (p. 13). It is also important to consider that polyps and intracondal cysts may be mistaken for nodules (Colton & Casper, 1996). This may lead to inflated reports of vocal nodules in treatment studies. Of the studies reviewed, the most frequently reported etiology was vocal nodules (15 of 49).

This is consistent with the findings of Dobres and associates (1990) and Herrington-Hall and associates (1985), who reported that vocal nodules occurred more frequently than other laryngeal pathologies. Some studies did not specify etiology (Smith & Thyme, 1976; Woo et al., 1994).

Boone and McFarlane (1993), Kotby and associates (1993), and Stemple and associates (1994) studied the effects of voice treatment techniques on speakers with no history of voice problems or laryngeal disease. The extent to which these results might differ for speakers who have voice problems and laryngeal disease was not considered. Stemple and associates (1994) suggest the efficacy of these approaches should be studied with subjects who have voice problems.

Duration of Symptoms. Information about the duration of the symptoms is important because usually the earlier the voice problem is identified the more positive is the prognosis for improvement (Colton & Casper, 1996). Few studies have reported the duration of the voice problem (Blood, 1994; Gray et al., 1965; Koufman & Blalock, 1988; Ramig et al., 1995, 1996; Roy & Leeper, 1993; Schneider, 1993; Smith et al., 1995; Verdolini-Masterson et al., 1994, 1995).

Nature and Severity of the Problem. Limited information has been provided about the nature and severity of voice problems, especially before voice treatment. It is possible that the outcome of treatment is related to the pre-treatment status of the voice, but this cannot generally be ascertained based on published reports.

Design of Study

Several strategies have been used to study the treatment of voice disorders (see Table 2). Specific design features of voice treatment research from the 1940s to 1996 have been described by Verdolini and associates (1998). Ramig and Verdolini (1998) draw attention to the need for "high-quality experimental designs" to study the effectiveness of voice treatment (p. S112).

Prospective Designs. According to Behrman and Orlikoff (1997) treatment "efficacy can only be measured under controlled experimental conditions, whether in a single subject or group design" (p. 13). The treatment versus no-treatment design requires random assignment of clients to treatment and no-treatment groups. There are limited data about the outcome of individuals treated and not treated for voice problems (Johnson, 1991). Only seven studies (Andersson & Schalen, 1998; Carding & Horsley, 1992; Chan, 1994; Robertson & Thomson, 1984; Stemple et al., 1994; Verdolini-Marston et al., 1994, 1995) used no-treatment or placebo control groups. The findings of these studies indicate that experimental groups show more improvement than no-treatment or placebo groups. For example, Stemple and associates (1994) reported significant changes for the experimental group but none for the control and placebo groups. The lack of no-treatment control groups in many studies may be related to various ethical concerns about withholding treatment. Single-subject experimental designs were used by Schneider (1993), Trullinger and associates (1988), and Blood

(1994). This type of design is useful in developing and modifying treatment, obtaining information about appropriateness of treatment, and providing pilot data to justify a group study to assess the efficacy of treatment. Enderby and Emerson (1995) reviewed studies of voice treatment and indicated single case studies provide evidence about the effectiveness of voice treatment “with one individual.”

Retrospective Designs. Four studies were retrospective (Bridger & Epstein, 1983; Lancer et al., 1988; Treole & Trudeau, 1997; Woo et al., 1994). The limitations of retrospective or ex post facto research are well known. Among the limitations are: (a) reliability and validity of data and (b) accuracy in extracting information from clinical files (DePoy & Gitlin, 1994; Maxwell & Sataker, 1997; Portney & Watkins, 1993; Schiavetti & Metz, 1997).

Questionnaires. Recently, client questionnaires have been used to assess the effect of voice treatment for vocal nodules and vocal fold paralysis. Leddy and associates (1997) compared the outcome of three types of voice treatment for 10 speakers with hyperfunctional voice problems and vocal nodules. Confidential voice treatment, resonant voice treatment, and the accent method were studied. All 10 speakers reported considerable or maximal gains on questionnaires developed by the American Speech-Language-Hearing Association (1995, 1997): Functional Communication Measure of Voice Disorders and Treatment Outcomes in Voice. Details were not provided about the outcome measures based on stroboscopy and electrography. Colton and Casper (1997) assessed the outcome of treatment for 45 speakers with vocal fold paralysis. Twenty-two speakers received voice treatment, and 23 had surgery. Client responses to questionnaires before and after treatment indicated that both groups improved. Differences between groups were not described. Andersson and Schalen (1998) used structured telephone interviews to determine clients' satisfaction with treatment. Several issues related to validity and reliability were discussed.

Questionnaires are inevitably subjective and on their own offer little evidence of treatment efficacy. In addition, it is difficult to determine to what extent patient reports about the effect of voice treatment are influenced by the way patients have been treated by their clinicians. Studies of treatment efficacy also need objective evidence to support the effectiveness of treatment.

Methods of Reporting Outcome. Assessing the outcome of voice treatment is difficult. Methods of assessment have included a variety of subjective and objective measures of voice.

Very few of the studies, only 6 of 49, reported success rates by percentage of subjects treated (Bridger & Epstein, 1983; Deal et al., 1976; Gordon et al., 1997; Koufman & Blalock, 1988; Woo et al., 1994; Xu et al., 1991). The success rates ranged from 25% (Gordon et al., 1997) to 71% (Koufman & Blalock, 1988). For clinical decisions about voice treatment, data are needed about percentages of success for a treatment strategy for a specific disorder or population.

Measures used to assess treatment outcome have changed over time. Current studies usually report both instrumental and perceptual measures. There has been an

increase in the use of instrumental measures in the 1990s when compared with earlier research. This increase may be related to increased awareness of limitations associated with perceptual assessment of voice (Behrman & Orlikoff, 1997; Kent, 1996; Kreiman, Garrett, Kempster, Erman, & Berke, 1993). Other recent trends are the use of experimental research designs, more focus on specific types of treatment, and comparing different treatments (McFarlane et al., 1991; Ramig et al., 1995, 1996; Smith et al., 1995; Stemple et al., 1994; Verdolini-Marston et al., 1994, 1995).

Functional outcome measures may be useful for measuring outcomes in voice disorders such as those developed by ASHA (1995, 1997) and by Jacobson and associates (1997). The Voice Handicap Index (Jacobson et al., 1997) consists of 30 items and has 120 points maximum. It measures clients' perceptions about the impact of a voice disorder on functional, emotional, and physical aspects of daily activities.

Summary and Conclusions

Treatment research is one of the most difficult types of research (Minifie & Flower, 1994). Treatment outcomes are affected by many factors, some of which are related to the client and others related to the clinician, such as training, experience, and preference of treatment technique(s). Thus, it is not easy to design research to ensure that whatever changes occur are the result of treatment. Nonetheless, additional research is needed on the efficacy of voice treatment. This need for continued research about the treatment of voice problems has also been discussed by Ramig and Verdolini (1998) and Verdolini and associates (1998).

Many treatment techniques for voice disorders have been proclaimed as effective although there are few data-based studies about treatment. Despite a large number of articles and books published in the last 10 years about voice problems, there are very limited data about the effectiveness of voice treatment and on which treatments are the most effective. The heterogeneity of outcome measures and inconsistent methods of reporting results prevent predicting a percentage of success for a treatment strategy used with a specific disorder or client population. There are other problems such as (a) differences in etiology of the voice problems; (b) small numbers of subjects; (c) inadequate information about nature and severity of the voice problems; (d) lack of appropriate control groups; (e) failure to report frequency, extent, and/or duration of treatment; (f) absence of long-term follow-up evaluations; and (g) lack of information about subjects such as gender. These problems should be avoided in future research.

Unfortunately, what is best for a specific client with a voice problem continues to depend on the client's symptoms and the clinician's preferences. There is clearly a need for data to support treatment decisions and the procedures used to treat voice problems. Some procedures may require less time to achieve the same outcome or have better long-term outcomes than others. Some procedures may be successful with a larger percentage of children and adults with voice problems than others. Furthermore, a

better understanding of voice treatment could have implications for the prevention of voice problems.

Much more needs to be known about the efficacy of treatment for voice problems. Future research regarding treatment efficacy should consider the following issues: (a) long-term effectiveness, (b) the extent to which severity influences the effectiveness of treatment, (c) treatment versus no treatment, (d) comparative effects of different forms of treatment, (e) efficacy of intensive voice treatment, and (f) comparison of clients' perceptions about treatment effectiveness with objective outcome measures. Fortunately, there is a recent trend toward recognition of these problems, and careful, systematic experimental evaluations of voice treatment are beginning to appear (Ramig et al., 1996, 1998; Smith et al., 1995; Stemple et al., 1994; Verdolini-Marston et al., 1994, 1995). If this trend continues, researchers, clinicians, and clients all stand to benefit.

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References

- Aaron, V. L., & Madison, C. L. (1991). A vocal hygiene program for high-school cheerleaders. *Language, Speech, and Hearing Services in Schools, 22*(1), 287–290.
- 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*, 229–231.
- American Speech-Language-Hearing Association. (1995). *User's guide: Phase I-Group I: National treatment outcome data collection project*. Rockville, MD: Author.
- American Speech-Language-Hearing Association. (1997). Treatment outcomes in voice. *Special interest division: Voice and voice disorders, 7*(1).
- Andersson, K., & Schalen, L. (1998). Etiology and treatment of psychogenic voice disorders: Results of a follow-up study of thirty patients. *Journal of Voice, 12*(1), 96–106.
- Andrews, M. L. (1991). The treatment of adolescents with voice disorders: Some clinical perspectives. *Language, Speech, and Hearing Services in Schools, 22*(3), 156–157.
- Andrews, M. L. (1993). Intervention with young voice users: A clinical perspective. *Journal of Voice, 7*(2), 160–164.
- Andrews, M. L., & Summers, A. C. (1991a). The awareness phase of voice therapy: Providing a knowledge base for the adolescent. *Language, Speech, and Hearing Services in Schools, 22*(3), 158–162.
- Andrews, M. L., & Summers, A. C. (1991b). *Voice therapy for adolescents*. San Diego, CA: Singular.
- Aronson, A. E. (1990). *Clinical voice disorders: An interdisciplinary approach*. New York: Thieme.
- Behrman, A., & Orlikoff, R. F. (1997). Instrumentation in voice assessment and treatment: What's the use? *American Journal of Speech-Language Pathology, 6*(4), 9–16.
- Berry, Q. C. (1991). Psychosocial aspects of adolescent dysphonia: An approach to treatment. *Language, Speech, and Hearing Services in Schools, 22*(3), 163–167.
- Blager, F. B., Gray, M. L., & Wood, R. P. (1988). Voice therapy techniques adapted to treatment of habit cough: A pilot study. *Journal of Communication Disorders, 21*, 393–400.
- Blood, G. W. (1994). Efficacy of a computer-assisted voice treatment protocol. *American Journal of Speech-Language Pathology, 3*(1), 57–66.
- Boone, D. R., & McFarlane, S. C. (1988). *The voice and voice therapy*. Englewood Cliffs, NJ: Prentice-Hall.
- Boone, D. R., & McFarlane, S. C. (1993). A critical view of the yawn-sigh as a voice therapy technique. *Journal of Voice, 7*(1), 75–80.
- Bridger, M. W. M., & Epstein, R. (1983). Functional voice disorders: A review of 109 patients. *The Journal of Laryngology and Otology, 97*, 1145–1148.
- Burk, K. W., & Brenner, L. E. (1991). Reducing vocal abuses: "It's got to be me." *Language, Speech, and Hearing Services in Schools, 22*(3), 173–178.
- Carding, P. N., & Horsley, I. A. (1992). An evaluation study of voice therapy in non-organic dysphonia. *European Journal of Disorders of Communication, 27*, 137–158.
- Case, J. L. (1991). *Clinical management of voice disorders*. 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*(3), 279–291.
- Colton, R. H., & Casper, J. K. (1996). *Understanding voice problems*. Baltimore, MD: Williams and Wilkins.
- Colton, R. H., & Casper, J. (1997). Patient-focused outcomes in voice therapy. In M. Iskowitz, *Advance for Speech-Language Pathologists and Audiologists, 7*(14), 10–11.
- Cook, J. V., Palaski, D. J., & Hanson, W. R. (1979). A vocal hygiene program for school-age children. *Language, Speech, and Hearing Services in Schools, 10*(1), 21–26.
- Deal, R. E., McClain, B., & Sudderth, J. F. (1976). Identification, evaluation, therapy, and follow-up for children with vocal nodules in a public school setting. *Journal of Speech and Hearing Disorders, 41*, 390–397.
- DePoy, E., & Gitlin, L. N. (1994). *Introduction to research*. St. Louis, MO: Mosby.
- Dobres, R., Lee, L., Stemple, J. C., Kummer, A. W., & Kretschman, L. M. (1990). Description of laryngeal pathologies in children evaluated by otolaryngologists. *Journal of Speech and Hearing Disorders, 55*(3), 526, 532.
- Drudge, M. K. M., & Philips, B. J. (1976). Shaping behavior in voice treatments. *Journal of Speech and Hearing Disorders, 41*, 398–411.
- Elias, A., Raven, R., Butcher, P., & Littlejohns, D. W. (1989). Speech therapy for psychogenic voice disorders: A survey of current practice and training. *British Journal of Disorders of Communication, 24*, 61–76.
- Elliott, N., Sundberg, J., & Gramming, P. (1997). Physiological aspects of a vocal exercise. *Journal of Voice, 11*(2), 171–177.
- Enderby, P., & Emerson, J. (1995). *Does speech and language therapy work?* San Diego, CA: Singular Publishing Group.
- Fex, B., Fex, S., Shiromoto, O., & Hirano, M. (1994). Acoustic analysis of functional dysphonia: Before and after voice therapy (accent method). *Journal of Voice, 8*(2), 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*(3), 277–285.
- Fox, C. M., & Ramig, L. O. (1997). Vocal sound pressure level

- and self-perception of speech and voice in men and women with idiopathic Parkinson disease. *American Journal of Speech-Language Pathology*, 6(2), 85–94.
- Froeschels, E.** (1943). Hygiene of the voice. *Archives of Otolaryngology*, 38, 122–130.
- Glaze, L. E.** (1996). Treatment of voice hyperfunction in the pre-adolescent. *Language, Speech, and Hearing Services in Schools*, 27(3), 244–256.
- Gordon, M. T., Pearson, L., Paton, F., & Montgomery, R.** (1997). Predictive assessment of vocal efficacy (PAVE): A method for voice therapy outcome measurement. *Journal of Laryngology and Otolaryngology*, 3, 129–133.
- Gray, B. B., England, G., & Mohoney, J. L.** (1965). Treatment of benign vocal nodules by reciprocal inhibition. *Behavior Research and Therapy*, 3, 187–193.
- Haskell, J. A.** (1991). Adjusting adolescents' voice self-perception. *Language, Speech, and Hearing Services in Schools*, 22(3), 168–172.
- Herrington-Hall, B. B., Lee, L., Stemple, J. C., Niemi, K. R., & McHone, M. M.** (1988). Description of laryngeal pathologies by age, sex, and occupation in a treatment-seeking sample. *Journal of Speech and Hearing Disorders*, 53(1), 57–64.
- Hillman, R. E., Gress, C. D., Haugraf, J., Walsh, M., & Bunting, G.** (1990). The efficacy of speech-language intervention: Voice disorders. *Services in Speech and Language*, 11(4), 297–310.
- Hufnagle, J., & Hufnagle, K.** (1984). An investigation of the relationship between speaking fundamental frequency and vocal quality improvement. *Journal of Communication Disorders*, 17, 95–100.
- Jacobson, B. H., Johnson, A., Grywalki, C., Silberleit, A., Jacobson, G., & Benninger, N. S.** (1997). The voice handicap index (VHI): Development and validation. *American Journal of Speech-Language Pathology*, 6(3), 66–70.
- Johnson, J. A., & Pring, T. R.** (1990). Speech therapy and Parkinson's disease: A review and further data. *British Journal of Disorders of Communication*, 25, 183–194.
- Johnson, T. S.** (1991). Principles and practices of prevention as applied to voice disorders. *Seminars in Speech and Language*, 12(1), 14–22.
- Kahane, J. C., & Mayo, R.** (1989). The need for aggressive pursuit of healthy childhood voices. *Language, Speech, and Hearing Services in Schools*, 20(1), 102–107.
- Kent, R. D.** (1996). Hearing and believing: Some limits to the auditory-perceptual assessment of speech and voice disorders. *American Journal of Speech-Language Pathology*, 5(3), 7–23.
- Kitzing, P., & Akerlund, L.** (1993). Long-time average spectrograms of dysphonic voices before and after therapy. *Folia Phoniatrica*, 45, 53–61.
- Koschke, D.** (1993). Accent method. In J. C. Stemple (Ed.), *Voice therapy: Clinical studies* (pp. 53–57). St. Louis, MO: Mosby.
- Kotby, M. N., Shiromoto, O., & Hirano, M.** (1993). The accent method of voice therapy: Effect of accentuations on FO, SPL, and airflow. *Journal of Voice*, 7(4), 319–325.
- Koufman, J. A., & Blalock, P. D.** (1982). Classification and approach to patients with functional voice disorders. *Annals of Otolaryngology, Rhinology, and Laryngology*, 91, 372–377.
- Koufman, J. A., & Blalock, P. D.** (1988). Vocal fatigue and dysphonia in the professional voice user: Bogart-Bacall syndrome. *Laryngoscope*, 98, 493–498.
- Kreiman, J., Garrett, B. R., Kempster, G. B., Erman, A., & Berke, G.** (1993). Perceptual evaluation of voice quality: Review, tutorial, and a framework for future research. *Journal of Speech and Hearing Research*, 36, 21–40.
- Lancer, J. M., Syder, D., Jones, A. S., & Le Bouillier, A.** (1988). The outcome of different management patterns for vocal cord nodules. *The Journal of Laryngology and Otolaryngology*, 102, 423–427.
- Larson, G. W., & Mueller, P. B.** (1992, Fall/Winter). A national survey of voice therapy practices and techniques. *Texas Journal of Audiology and Speech Pathology*, 18, 14–16.
- Leddy, M., Samlan, R., & Poburka, B.** (1997). Effective treatments for hyperfunctional voice disorders. In A. Shoemaker, *Advance for Speech-Language Pathologists and Audiologists*, 7(9), 18.
- Madison, C. L., Meadors, D. L., & Miller, S. Q.** (1984). A survey study of a public school voice clinic program. *Language, Speech, and Hearing Services in Schools*, 15(4), 276–280.
- Maxwell, D. L., & Sataker, E.** (1997). *Research and statistical methods in communication disorder*. Baltimore: Williams & Wilkins.
- McFarlane, S. C.** (1988). Treatment of benign laryngeal disorders with traditional methods and techniques of voice therapy. *Ear, Nose, and Throat Journal*, 67, 425–435.
- McFarlane, S. C., Holt-Romeo, 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(1), 45–48.
- McFarlane, S. C., & Watterson, T. L.** (1990). Vocal nodules: Endoscopic study of their variations and treatment. *Seminars in Speech and Language*, 11(1), 47–59.
- McNamara, A. P., & Perry, C. K.** (1994). Vocal abuse prevention practices: A national survey of school-based speech-language pathologists. *Language, Speech, and Hearing Services in Schools*, 25(2), 105–111.
- Minifie, F. D., & Flower, R. M.** (1994). A voice for the future. In F. D. Minifie (Ed.), *Introduction to communication services and disorders* (pp. 673–689). San Diego, CA: Singular.
- 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(2), 172–178.
- Mueller, P. B., & Larson, G. W.** (1992). Voice therapy practices and techniques: A survey of voice clinicians. *Journal of Communication Disorders*, 25, 251–260.
- National Center for Voice and Speech.** (1994). *Voice therapy and training*. Iowa City: The University of Iowa.
- Nickel, D. G., Middleton, G. F., & Brand, M. N.** (1992, Fall). The effectiveness of a vocal health program for the elementary classroom. *Rocky Mountain Journal of Communication Disorders*, 21–26.
- Nilson, H., & Schneiderman, C. R.** (1983). Classroom program for the prevention of vocal abuse and hoarseness in elementary school children. *Language, Speech, and Hearing Services in Schools*, 14(2), 121–127.
- Peppard, R. C.** (1996). Management of functional voice disorders in adolescents. *Language, Speech, and Hearing Services in Schools*, 27(3), 257–270.
- Portney, L. G., & Watkins, M. P.** (1993). *Foundations of clinical research*. Norwalk, CT: Appleton and Large.
- Prater, R. J., & Swift, R. W.** (1984). *Manual of voice therapy*. Boston, MA: Little, Brown.
- Ramig, L. O.** (1997). How effective is the Lee Silverman voice treatment? *Asha*, 39(1), 34–35.
- Ramig, L. O., Countryman, S., Thompson, L. L., & Horii, Y.** (1995). Comparison of two forms of intensive speech treatment for Parkinson's disease. *Journal of Speech and Hearing Research*, 38(6), 1232–1251.
- Ramig, L. O., Countryman, S., O'Brian, C., Hoehn, M., & Thompson, L.** (1996). Intensive speech treatment for patients

- with Parkinson's disease. *American Academy of Neurology*, 47, 1496–1504.
- Ramig, L. O., & Dromey, C.** (1996). Aerodynamic mechanisms underlying treatment-related changes in vocal intensity in patients with Parkinson disease. *Journal of Speech and Hearing Research*, 30(4), 798–807.
- Ramig, L. O., & Verdolini, K.** (1998). Treatment efficacy: Voice disorders. *Journal of Speech, Language, and Hearing Research*, 41, S101–S116.
- Reed, G. G.** (1980). Voice therapy: A need for research. *Journal of Speech and Hearing Disorders*, 45, 157–169.
- Robertson, S. J., & Thomson, F.** (1984). Speech therapy in Parkinson's Disease: A study of the efficacy and long term effects of intensive treatment. *British Journal of Disorders of Communication*, 19, 213–234.
- Robey, R. P.** (1998). A meta-analysis of clinical outcomes in the treatment of aphasia. *Journal of Speech, Language, and Hearing Research*, 41, 172–187.
- Roy, N.** (1993). Ventricular dysphonia following long-term endotracheal intubation: A case study. *Journal of Otolaryngology*, 23(3), 189–193.
- Roy, N., & Leeper, H. A.** (1993). Effects of the manual laryngeal musculoskeletal tension reduction technique as a treatment for functional voice disorders: Perceptual and acoustic measures. *Journal of Voice*, 7(3), 242–249.
- Sander, E. K.** (1989). Arguments against the aggressive pursuit of voice therapy for children. *Language, Speech, and Hearing Services in Schools*, 20(1), 94–101.
- Saniga, R. D., & Carlin, M. F.** (1991). Varying signal-to-noise ratio in adolescent voice therapy. *Language, Speech, and Hearing Services in Schools*, 22(3), 179–188.
- Sataloff, R. T.** (1987a). The professional voice: Part I: Anatomy, function, and general health. *Journal of Voice*, 1(1), 92–104.
- Sataloff, R. T.** (1987b). The professional voice: Part III: Common diagnoses and treatments. *Journal of Voice*, 1(3), 283–292.
- Schiavetti, N., & Metz, D. E.** (1997). *Evaluating research in communication disorders*. Boston: Allyn & Bacon.
- Schmidt, C. P., & Andrews, M. L.** (1993). Consistency in clinicians and clients' behavior in voice therapy: An exploratory study. *Journal of Voice*, 7(4), 354–358.
- Schneider, P.** (1993). Tracking change in dysphonia: A case study. *Journal of Voice*, 7(2), 179–188.
- Shearer, W. M.** (1972). Diagnosis and treatment of voice disorders in school children. *Journal of Speech and Hearing Disorders*, 37, 215–221.
- Smith, M. E., Ramig, L. O., Dromey, C., Perez, K. S., & Samandari, R.** (1995). Intensive voice-treatment in Parkinson disease: Laryngoendoscopic findings. *Journal of Voice*, 9(4), 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.
- Stemple, J. C.** (1984). *Clinical voice pathology: Theory and management*. Columbus, OH: Charles E. Merrill.
- 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*, 8(3), 270–278.
- Treole, K., & Trudeau, M. D.** (1997). Changes in sustained tasks among women with bilateral vocal nodules before and after voice therapy. *Journal of Voice*, 11, 462–469.
- Trullinger, R. W., Emanuel, F. W., Skenes, L. L., & Malpass, J. C.** (1988). Spectral noise level measurements used to track voice improvement in one patient. *Journal of Communication Disorders*, 21, 447–457.
- Verdolini, K.** (1997). Applying research. *Asha*, 39(1), 34–35.
- Verdolini, K., Ramig, L., & Jacobson, B.** (1998). Outcomes measurement in voice disorders. In C. M. Frattali (Ed.), *Measuring outcomes in speech-language pathology* (pp. 354–356). NY: Thieme Medical Publishers.
- Verdolini-Marston, K., Burke, M. K., Lessac, A., Glaze, L., & Caldwell, E.** (1995). Preliminary study of two methods of treatment for laryngeal nodules. *Journal of Voice*, 9(1), 74–85.
- Verdolini-Marston, K., Sandage, M., & Titze, I. R.** (1994). Effect of hydration treatments on laryngeal nodules and polyps and related voice measures. *Journal of Voice*, 8(1), 30–47.
- Wilson, D. K.** (1987). *Voice problems of children*. Baltimore, MD: Williams & Wilkins.
- Woo, P., Casper, J., Colton, R., & Brewer, D.** (1994, September). Diagnosis and treatment of persistent dysphonia after laryngeal surgery: A retrospective analysis of 62 patients. *Laryngoscope*, 104, 1084–1091.
- Xu, J. H., Ikeda, Y., & Komiyama, S.** (1991). Bio-feedback and the yawning breath pattern in voice therapy: A clinical trial. *Auris: Nasus: Larynx*, 18, 65–77.
- Yamaguchi, H., Yotsukure, Y., Sata, H., Wotanabe, Y., Hirose, H., Kabayashi, N., & Bless, D. M.** (1993). Pushing exercise program to correct glottal incompetencies. *Journal of Voice*, 7(3), 250–256.
- Yorkston, K. M.** (1996). Treatment efficacy: Dysarthria. *Journal of Speech and Hearing Research*, 39, S46–S57.

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