
An Evaluation of the Effects of Two Treatment Approaches for Teachers With Voice Disorders: A Prospective Randomized Clinical Trial

Nelson Roy

Steven D. Gray

Mindy Simon

The University of Utah

Salt Lake City

Heather Dove

The University of Utah

Hospital and Clinics

Salt Lake City

Kim Corbin-Lewis

Utah State University

Logan

Joseph C. Stemple

The Blaine Block Institute

for Voice Analysis and

Rehabilitation

Dayton, OH

Teachers commonly report voice problems and often seek medical assistance for voice-related complaints. Despite the prevalence of voice disorders within this occupation, there are no studies evaluating the effectiveness of treatment programs designed to remedy the voice problems of teachers. To assess the functional effects of two voice therapy approaches, 58 voice-disordered teachers were randomly assigned to 1 of 3 groups: vocal hygiene (VH, $n = 20$), vocal function exercises (VFE, $n = 19$), and a nontreatment control group (CON, $n = 19$). Subjects completed the Voice Handicap Index (VHI)—an instrument designed to appraise the self-perceived psychosocial consequences of voice disorders—before and following a 6-week treatment phase. The VFE and VH subjects also completed a posttreatment questionnaire regarding the perceived benefits of treatment. Only the group who adhered to the VFE regimen reported a significant reduction in mean VHI scores ($p < .0002$). Furthermore, when compared to the VH group, the exercise group reported more overall voice improvement ($p < .05$) and greater ease ($p < .02$) and clarity ($p < .01$) in their speaking and singing voice after treatment. These findings suggest that the VFE should be considered as a useful alternative or adjunct to vocal hygiene programs in the treatment of voice problems in teachers.

KEY WORDS: voice disorders, teachers, treatment, vocal hygiene, vocal function exercises

Voice disorders are a relatively common occupational hazard of teaching school (Herrington-Hall, Lee, Stemple, Niemi, & McHone, 1988; Mattiske, Oates, & Greenwood, 1998; Pekkarinen, Himberg, & Pentti, 1992; Rantala, Haataja, & Vilkmán, 1997; Russell, Oates, & Greenwood, 1998; Smith, Lemke, Taylor, Kirchner, & Hoffman, 1998). Teachers place heavy demands on their vocal mechanism by speaking loudly over background classroom noise for long periods (Pekkarinen & Viljanen, 1991; Rantala, Paavola, Korkko, & Vilkmán, 1998; Sapienza, Crandell, & Curtis, 1999). Teachers' repeated exposure to upper respiratory infections and other airborne irritants complicate the problem. Several studies have confirmed that teachers are likely to develop voice problems (Fritzell, 1996; Gotaas & Starr, 1993; Titze, Lemke, & Montequin, 1997). Both male and female teachers reported a higher rate of specific voice symptoms and symptoms of physical discomfort compared to people in other occupations (Smith, Gray, Dove, Kirchner, &

Heras, 1997). Over 38% of teachers complained that teaching had an adverse effect on their voice, and 39% of those had reduced their teaching activities as a result (Smith, Kirchner, Taylor, Hoffman, & Lemke, 1998). One in five teachers surveyed reported missing work because of a voice problem (Smith et al., 1997). Although the economic and work-related impact of voice disorders on the teaching profession has not been fully determined, it is clear that vocal dysfunction interferes with job performance and attendance. Severe voice problems can force a teacher to leave the profession permanently (Sapir, Keidar, & Mathers-Schmidt, 1993).

To help teachers cope with the voice demands of their high-risk vocation, educational, prevention, and treatment programs need to be developed and assessed (Russell, Oates, & Greenwood, 1998). Despite the frequency of voice problems among teachers, there are few controlled studies evaluating the effects of treatments intended to safeguard this group from the untoward effects of their professional voice use. This investigation was therefore designed to assess the effects of two voice treatment approaches with teachers who report voice problems.

One popular treatment approach for a broad spectrum of voice disorders is to instruct patients in proper vocal hygiene (VH). Without exception, contemporary voice texts emphasize the importance of proper care of vocal fold tissue, suggesting that certain vocal behaviors and patterns, lifestyle, and diet choices can be either harmful or helpful to vocal fold tissue and consequently voice production (Andrews, 1995; Boone & McFarlane, 2000; Case, 1996; Colton & Casper, 1996; Koschke & Rammage, 1997; Prater & Swift, 1984; Stemple, Glaze, & Klaben, 2000). To preserve or restore normal voice, the hygiene approach typically requires the patient to eliminate those behaviors that are potentially harmful and replace them with more vocally hygienic substitutes. Although some variation exists, most VH programs include instruction regarding (a) the amount and type of voice use, (b) vocal behaviors thought to be phonotraumatic, (c) hydration issues, and (d) a discussion of lifestyle and diet factors that can support or interfere with a healthy voice.

Despite the popularity of VH programs among practicing clinicians, there are few objective data, to date, evaluating the short- or long-term benefits of the VH approach for voice-disordered subjects. Most of the extant objective literature has been confined to assessing the effects of improved hydration/humidification on voice function (Verdolini-Marston, Sandage, & Titze, 1994; Verdolini-Marston, Titze, & Druker, 1990; Verdolini, Titze, & Fennell, 1994). Although no single study has evaluated the consequences of VH instruction with a group of teachers who are experiencing voice problems, the value of VH with other groups has recently been assessed. Broaddus-Lawrence, Treole, McCabe, Allen, and Toppin

(2000) administered 4 hours of VH instruction/education to 11 singers. Despite reports of satisfaction with the quality and content of the VH education, comparison of pre- and postinstruction survey data revealed no significant behavioral changes at 6 weeks postinstruction. The singers did not reduce the number of self-reported phonotraumatic behaviors, nor did they report significant changes in hydration and/or warm-up practices. Furthermore, the results also indicated that the education program altered none of the subject's perceptions of their singing or speaking voices.

In another study, Chan (1994) evaluated the effects of a 2-month VH program with 12 non-voice-disordered kindergarten teachers. When compared to a nontreatment control group, the teachers who followed the VH program showed improvements in phonatory function based on acoustic analysis of pre- and posttreatment audio-recordings. Whether these results are applicable to teachers who are experiencing voice problems requires experimental validation.

A second voice therapy approach that has been used with a wide range of voice disorders is vocal function exercises (VFE). These exercises, as described by Stemple and colleagues (Sabol, Lee, & Stemple, 1995; Stemple, Lee, D'Amico, & Pickup, 1994), claim to strengthen and rebalance the subsystems involved in voice production (i.e., respiration, phonation, and resonance) through a program of systematic exercise. Stemple speculates that by improving the "strength, endurance and coordination" of the systems involved in voice production, the exercises help rehabilitate the voice and insulate the patient from negative vocal effects of extended voice use (Stemple, Glaze, & Klaben, 2000). In the VFE approach, four specific exercises are practiced at home, two times each twice daily, for a period of 6 to 8 weeks. The exercises include maximum vowel prolongations and pitch glides, using specific pitch and phonetic contexts. All exercises are produced as softly as possible combined with a forward placement of the tone. Audiotapes are provided to guide practice sessions and patients plot their progress daily. The four exercises and their salient procedural characteristics are described in detail in Appendix B.

Although the assumptions regarding the physiological bases of the exercises have not been empirically validated, the exercises have proven useful in improving and enhancing selected aspects of vocal performance in speakers with healthy voices (Stemple et al., 1994) and in healthy singers (Sabol, Lee, & Stemple, 1995). To date, however, reports evaluating the effectiveness of VFE with voice-disordered populations have been exclusively anecdotal. There are no data evaluating the utility of these exercises with a voice-disordered teacher population.

On the whole, the VH and VFE programs represent conceptually different strategies for voice improvement.

The hygiene approach restricts the type and amount of voice use and is more compatible with a “vocal diet” orientation to voice disorder management. If the patient observes the diet for a sufficient duration, it is assumed that improvement in both vocal fold tissue and voice function should follow. On the contrary, vocal function exercises aim to teach a new motor skill set that can preserve the voice without necessarily restricting the amount or type of voice use. Although both the VH and VFE approaches aim to rehabilitate the voice and protect the individual from potentially phonotraumatic vocal behavior, the methods proposed to accomplish these goals are procedurally and theoretically dissimilar. These two conceptually different approaches were selected for this study to compare the relative benefits of so-called “diet” versus “exercise” programs.

Method

Participants

Sixty full-time elementary and secondary school teachers with a history of voice problems were identified and invited to participate by school-based speech-language pathologists. All subjects were teachers in Utah who, by their report, were presently experiencing voice difficulties and/or had regularly experienced voice problems in the past. Each subject was randomly assigned to one of three groups (i.e., no treatment control, vocal hygiene, and vocal function exercises). Each group was composed of 20 subjects. Two subjects (i.e., one control and one VFE) withdrew before completion of the study, leaving a total of 58 participants. Teacher characteristics for each group are summarized in Table 1. Case history questionnaires were administered, but some of the teachers did not answer every question. Questions regarding teacher age were answered by only 55% of the respondents. Only 76% and 79% of the respondents, respectively, answered questions about the number of hours of teaching per day and their teaching experience. Thus, the statistics reported here in the text and in Table 1 reflect a number of missing data points.

Data from the subset of participants who did respond were statistically analyzed using one-way analysis of variance (ANOVA) procedures to evaluate between-group differences on each variable of interest. Nonsignificant

F tests revealed that no two groups were significantly different at the .05 level on the variables of age [$F(2, 31) = 0.41, p = .96$], number of hours of teaching per day [$F(2, 44) = .24, p = .91$], and teaching experience [$F(2, 45) = .34, p = .72$]. Thus, the randomization procedure appeared to achieve equivalence of groups on these specific subject characteristics.

Description of Voice Clinician Training

Eleven speech-language pathologists from the State of Utah volunteered to serve as voice clinicians. All clinicians held a graduate degree in speech-language pathology, were employed in school, university, or medical settings, and had treated voice disorders in the past. The average length of professional experience was 15.1 years ($SD = 8.21$). To standardize the treatment protocol, each speech-language pathologist participated in a single training session. The training session involved a complete explanation of the study’s purpose, as well as instruction in the salient procedural aspects of the VFE program. In addition, clinicians were provided with a VH program, with written instructions to be followed by the teachers (Appendix A). The VH program was adapted from a Morrison et al. (1994) template and was supplemented with suggestions from other sources (Andrews, 1995; Boone & McFarlane, 2000; Case, 1996; Colton & Casper, 1996; Koschkee & Rammage, 1997; Prater & Swift, 1984; Stemple, Glaze, & Klaben, 2000). Based on an informal survey of contemporary voice treatment manuals, the Morrison et al. hygiene program represented a synthesis of the components included in most traditional VH treatment programs. All voice clinicians were familiar with standard VH programs and had administered such programs in the past. Because the technical expertise required to administer the hygiene program was judged to be minimal, and all clinicians had prior experience, extensive formal training in the VH program was deemed unnecessary.

The clinicians were provided with literature summarizing the most significant components of the VFE program (Appendix B). Each clinician either attended a live presentation by Dr. Joseph Stemple regarding the exercises, or viewed a 30-minute videotape of Dr. Stemple describing and demonstrating the important features

Table 1. Summary of subject characteristics for each treatment group.

Group	Mean age (<i>SD</i>)	Mean no. of yrs teaching (<i>SD</i>)	Mean no. of hrs teaching/day (<i>SD</i>)
Vocal function exercises	43.6 (13.2)	10.9 (7.9)	5.11 (1.4)
Vocal hygiene	45.1 (8.7)	13.6 (10.8)	5.3 (1.7)
Nontreatment control	44.2 (11.3)	11.5 (9.7)	5.13 (1.7)

of the therapy regimen. The videotaped presentation was supplemented with instruction by the first author (NR). During this training session, clinicians received brief guided practice and corrective feedback regarding the exercises. The training session did not exceed 2 hours. At the end of the training session, each voice clinician received information/instruction packets to help guide her through the 6-week treatment protocol. Audiotapes of male and female speakers demonstrating the exercise program were provided. In addition, copies of the training videotape were made available to all clinicians for further review and practice.

Procedures

The teachers with voice disorders underwent treatment over a 6-week period. Clinicians met with subjects on four occasions over this training period. In the first contact, the subject (i.e., teacher) read and signed the consent form, then completed the Voice Handicap Index (VHI), as described in the next section. Instruction was provided in the assigned therapy program (i.e., VFE or VH), and follow-up appointments were scheduled at 2 weeks, 4 weeks, and 6 weeks (final contact). For both the VFE and VH groups, the initial contact required a thorough review of the assigned therapy program. For the VFE group, each teacher was given an audiotape for later use to guide his or her practice sessions. To limit biasing subjects, clinicians were admonished to avoid discussing any of their beliefs regarding the superiority of one treatment over another.

For the second and third contacts, at 2 and 4 weeks respectively, treatment sessions involved reviewing therapy techniques and progress with the subject to ensure that he/she was complying with the therapy program. In the case of the vocal exercise group, the clinician reviewed the specific exercises (and voice record sheets), observed the teacher performing the exercises, and provided guidance and corrective feedback regarding performance. The subjects tracked the maximum duration of productions during the warm-up and power exercises during their twice-daily practice sessions (i.e., Exercise 1 and 4; see Appendix B). In the case of the VH group, the clinician reviewed the suggestions contained on the vocal hygiene instruction sheets, answered questions, provided clarification if necessary, and discussed compliance. Regardless of the therapy approach, these contacts did not exceed 1 hour.

At the time of final contact (6 weeks), treatment was reviewed and the teacher completed the VHI and a teacher questionnaire. The teacher questionnaire was designed to learn more about each subject's voice problem/history and the degree to which each individual believed he or she had benefited from the treatment

program. (See Appendix C for an abridged version of the questionnaire.)

At this time, the clinician also completed a questionnaire designed to provide background information and provided an evaluation of his or her confidence/comfort level with the prescribed treatment approaches. Clinicians were specifically asked to rate their level of confidence on a 5-point scale by responding to the following two questions:

1. To what extent did you feel confident administering the vocal function exercise program?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot
2. To what extent did you feel confident administering the vocal hygiene program?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot

Subjects assigned to the "no treatment control group" had only two contacts with the clinician. In the first contact, the subject read and signed the consent form, completed the VHI, and scheduled a follow-up appointment in 6 weeks. No advice aimed at improving voice function was provided. At the end of the 6-week period, the subject returned to complete the VHI and voice history questionnaire only.

In order to minimize the risk of clinician influence on ratings of voice handicap and treatment effectiveness, each subject completed the posttreatment VHI and teacher questionnaire privately. Subjects were encouraged to answer all questions honestly, and they were assured that only the principal investigators would view their ratings. Subjects inserted the completed questionnaires into a labeled envelope and sealed it. Any discussion between the clinician and teacher regarding treatment effectiveness was deferred until the subject had completed the questionnaires independently.

The Voice Handicap Index (VHI)

To assess the effect of therapy, each teacher completed the Voice Handicap Index before and following the 6-week treatment period. The VHI is a statistically robust instrument designed to assess the self-perceived psychosocial consequences of voice disorders (Jacobson et al., 1997). This self-report inventory consists of 30 statements that evaluate a patient's judgment regarding the relative impact of his or her voice disorder on daily activities. Subjects rate each statement, indicating how frequently he or she has the experience in the question, on a 5-point equal-appearing interval scale with the following values: 0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always. The

VHI generates a total score (ranging from 0 to 120) and three subscale scores: Functional (F), Physical (P), and Emotional (E). It has been psychometrically validated with strong internal consistency, reliability, and test-retest stability. According to its authors, the VHI can be used as a measure of the effectiveness of specific treatment techniques and as a component of functional outcomes measurement (Jacobson et al., 1997).

Teacher Questionnaire

To supplement the VHI, subjects in the two treatment groups also completed a four-question, posttreatment questionnaire to assess their perceived degree of voice improvement and compliance with the treatment program (Appendix C). Subjects were asked to rate their extent of improvement and compliance on a 5-point scale whereby 1 = Not at all and 5 = A lot. The four questions related to (a) voice symptom improvement, (b) vocal clarity, (c) ease of speaking and singing voice, and (d) degree of compliance with the prescribed treatment program.

Results

To assure the equivalence of groups on pretreatment VHI levels, pretreatment differences between groups for mean VHI scores were tested using a one-way analysis of variance (ANOVA). Fisher's least significant difference (LSD) procedure was used to compare the means. The protected *F* test did not reveal omnibus differences between groups [$F(2, 57) = .654, p = .52$]. No significant between-group differences were detected at the 0.05 level on any of the pretreatment VHI subscales or total VHI score, thus validating the randomization process. Repeated measures analysis of variance (ANOVA) was used to assess the group, time, and Group \times Time interaction effects. Treatment, if effective, should only change the posttreatment VHI scores; thus, the primary test of interest was the Group \times Time interaction effect. If a significant interaction effect was identified based upon the omnibus *F* test, within subjects linear contrasts were performed to compare the pre- and posttreatment means using generalized least squares means tests within SAS PROC MIXED (SAS Institute Inc., Cary, NC). These protected tests have the same degrees of freedom as the denominator degrees of freedom in the ANOVA.

Because time trends and significance patterns for the individual subscales and total VHI score were comparable, only the total VHI data are detailed here. The main effects of group [$F(2, 55) = .77, p = .47$] and time [$F(1, 55) = 2.31, p = .13$] are not significant. A significant *F* test for the interaction effect [$F(2, 55) = 7.30, p < .0015$] permits comparison of pre- and posttreatment mean VHI scores for each treatment group. Group means

and standard error data for total VHI scores before and following the 6-week treatment period are presented graphically in Figure 1. Inspection of the results reveals that, following the 6-week treatment period, a significant reduction in mean VHI scores was observed for the VFE group only. The VHI score was reduced from a pretreatment mean of 31.58 to a posttreatment mean of 19.95 ($p < .0002$). No significant change in mean VHI scores was detected for the vocal hygiene ($p = .918$) or nontreatment control groups ($p = .233$).

In addition to the VHI scores, mean data from the posttreatment questionnaire for the VH and VFE groups were compared using an independent samples *t* test. The results confirmed that the subjects in the VFE group assign significantly higher ratings to their degree of voice improvement following therapy. The VFE group consistently reported significantly higher ratings of perceived benefit (Figure 2) on each comparison involving (a) extent of voice symptom improvement [$t(37) = -2.04, p < .05$], (b) vocal clarity [$t(37) = -2.46, p < .02$], and (c) ease of voice production [$t(37) = -2.73, p < .01$].

Extraclinical compliance can influence the effectiveness of therapy. To assess whether group differences in reported treatment compliance could account for the superior results observed for the VFE group, an independent samples *t* test was administered. The VFE and VH groups did not differ significantly on self-reported compliance with their treatment programs [$t(37) = -.41, p = .682$]. Therefore, both groups reported comparable levels of treatment compliance (Figure 2).

Clinicians' self-confidence in their ability to correctly administer a particular treatment has also been purported to influence treatment results. To assess whether clinician confidence differed significantly depending on the

Figure 1. Mean pre- and posttreatment Voice Handicap Index (VHI) scores and standard errors for each group. The asterisk indicates a significant difference based upon comparisons of pre- and posttreatment means ($p < .05$).

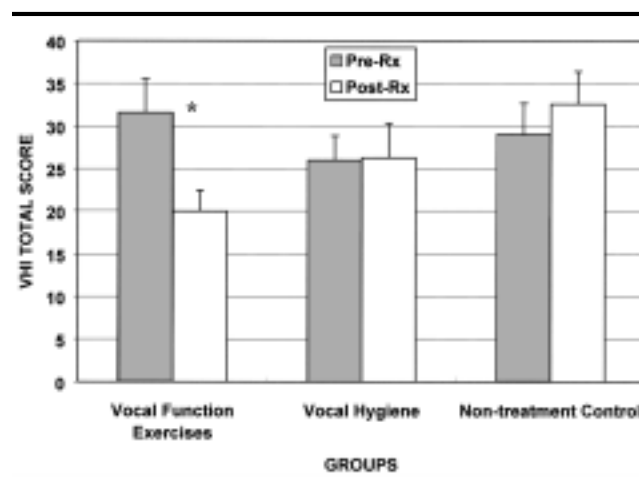
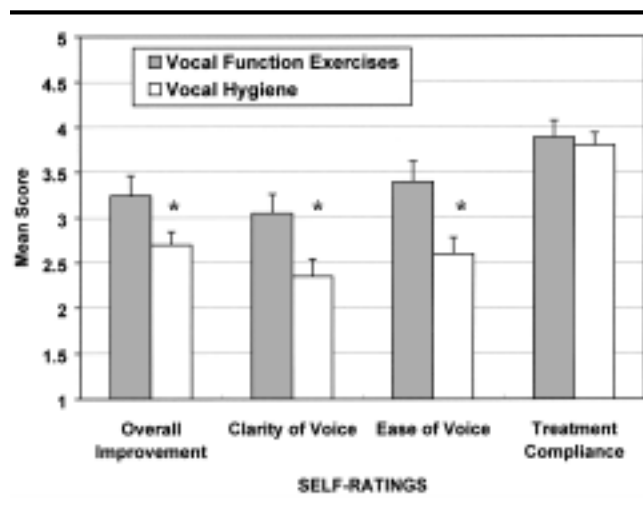


Figure 2. Mean ratings and standard errors for the Vocal Function Exercise (VFE) and vocal hygiene (VH) groups on the posttreatment questionnaire. After treatment, subjects were asked to rate their extent of voice improvement and treatment compliance on a 5-point scale whereby 1 = not at all and 5 = a lot. The four questions related to (a) voice symptom improvement, (b) vocal clarity, (c) ease of speaking and singing voice, and (d) degree of compliance with the prescribed treatment program. Asterisks indicate a significant difference between groups ($p < .05$).



treatment administered, an independent samples t test was used. Clinicians were more confident in their ability to correctly administer the VH program than the VFE. However, this difference in the level of self-reported clinician confidence only approached statistical significance [$t(10) = -2.19, p = .054$].

Discussion

Voice problems are common among teachers. This prospective, randomized clinical trial used the VHI and a posttreatment questionnaire to evaluate selected aspects of two voice therapy approaches administered over a 6-week period to teachers with voice disorders. Based on comparisons of pre- and posttreatment VHI scores, the subjects who underwent VFE treatment demonstrated greater improvement in the degree of patient-perceived handicap than those who underwent VH treatment. The VH and nontreatment control groups did not experience any significant change in VHI scores following the 6-week study period. The patient-perceived benefit of the VFE program was also verified by posttreatment questionnaires completed by the subjects. When compared to the VH group, the exercise group reported more overall voice improvement, as well as greater ease and clarity of their speaking and singing voice, after treatment. Because both groups reported similar levels of extraclinical compliance, the findings cannot be explained on the basis of obvious group differences in

reported compliance with the treatment program. These results provide support for the clinical utility of the VFE program as a treatment alternative for this group of professional voice users.

Although the results seem to suggest that VFE outperformed VH on the parameters of interest, a discussion of other possible interpretations of the data is warranted. One rival explanation for the results is the possibility that by spending more time training clinicians in the VFE program, the researchers inadvertently biased the voice clinicians to favor the VFE program and the clinicians passed on this bias to the subjects. The apparent superiority of the VFE program over the VH approach would then merely reflect bias as a consequence of the uneven emphasis placed on VFE during the clinician training period. Although this possibility exists, it is unlikely that the differences observed in the treatment outcomes could be explained solely on the basis of differences in clinician training. The clinicians received only short-term training (less than 2 hours) in the VFE. This amount of training is unlikely to result in a substantial difference when one considers the previous experience and familiarity with administration of VH programs of the participating speech-language pathologists (the clinicians had an average of 15 years of clinical experience).

Perhaps more compelling evidence against this rival interpretation exists in the clinicians' self-evaluations of their confidence to correctly administer the two forms of treatment. In spite of receiving more training in the VFE program, the clinicians actually reported less confidence in their ability to deliver VFE instruction. It seems more likely that this lower confidence level would attenuate treatment effects for the VFE group and not the VH group. With this in mind, it is difficult to accept that clinician bias alone would constitute a sufficient explanation for the robust treatment effects observed for the VFE group.

Historically, the VH approach has long held an important place among voice clinicians. These findings, however, suggest that VH instruction (as delivered in this study) may not produce the desired treatment results with a voice-disordered teacher population. Before generalizing the results, certain limitations of this investigation need to be considered, and it would be premature and ill advised to abandon VH instruction based on this single investigation.

First, the VH program used in this investigation was purely didactic. Often, vocal hygiene instruction is used in conjunction with other forms of treatment of voice disorders, and such instruction may be beneficial when incorporated with other "more active" approaches to treatment. Vocal hygiene treatment often includes more formal procedures to establish, carry over, and

maintain desired behaviors (i.e., charting, specific home practice activities). Lack of such procedures may be one reason why the particular VH program used here was ineffective. In addition, the VH program might require more time to be effective. That is, the 6-week treatment period may have been too short for therapeutic levels to be detected (Chan, 1994). Further study is needed to evaluate how variations in procedural aspects and duration of VH programs might influence treatment outcomes.

Second, the precise nature of the voice disturbance, including the presence, type, and severity of vocal fold pathology, was not defined. The cohort of teachers with voice disorders studied here was broadly inclusive and presumably encompassed a wide variety of laryngeal problems/pathologies. Although both VH and VFE programs are professed to be valuable with a broad spectrum of laryngeal disorders, future research should include pretreatment stroboscopic examinations to confirm the presence/absence of laryngeal pathology and to more precisely define the disorders most responsive to each treatment modality. It may be that certain types of vocal pathology are more amenable to specific treatments, including VH.¹

Third, there is the difficult issue of treatment compliance. Although no between-group differences were detected on self-reported compliance levels, relying on self-report data may not adequately ascertain a subject's true level of compliance with treatment suggestions. Thus actual/real between-group differences on compliance may not be detected. The results of this investigation do concur with the recent Broaddus-Lawrence et al. (2000) study that showed negligible changes in voice and behavior of singers following instruction in VH. For many patients, it might be more difficult to comply with a VH program that expects basic lifestyle changes, as compared to a VFE program that requires two short practice sessions per day.

Fourth, whereas self-perceived (i.e., patient-based) handicap/health-related quality of life measures are accepted and ubiquitous outcomes measures in the fields of medicine, surgery, and rehabilitation (Frederic, Pugliano, & Piccirillo, 1999), future studies should consider auditory-perceptual, acoustic, and physiologic analysis methods to assess treatment effects. It is possible that such measures may be more sensitive to subtle changes in phonatory function following VH that were not detected using the Voice Handicap Index alone.

¹It should be noted that following completion of the study, each teacher was sent a letter from the investigators encouraging the subject to pursue medical and/or otolaryngological assessment. The letter also stated that chronic voice problems could be associated with serious medical problems that deserve attention, and which may respond to medical or surgical management. It is important to acknowledge that in normal clinical practice, voice therapy should not be started until a patient has been evaluated by a physician.

These limitations notwithstanding, the data clearly point to the need for further objective evaluation of the clinical value of VH instruction as a broad-spectrum versus narrow-spectrum treatment program.

Although several questions remain unanswered, the results of this investigation represent the first objective evidence to support the clinical utility of vocal function exercises with a voice-disordered sample. Because the VFE program is a training approach that claims to combine principles of exercise physiology (Saxon & Schneider, 1995) with qualitative aspects of voice production (i.e., frontal focus/placement, pharyngeal widening, ease of voice onset), it is impossible, from this clinical trial, to identify the factors underlying the voice improvement. The meticulous execution of the exercises may not be as critical as having patients engage in tasks that require them to monitor auditory, proprioceptive, and kinesthetic feedback while vocalizing. It may be that deliberately attending to sensory/qualitative aspects of voice production on a twice-daily basis is sufficient to engender positive voice changes. Future studies need to identify the critical aspects of the treatment regimen. The long-term effects of the VFE program will also need to be studied carefully. Stemple (2000) prescribes a tapering/maintenance program for his vocal function exercises. Whether the improvements observed can be sustained after terminating the exercises remains unanswered.

Acknowledgments

The authors wish to thank the speech-language pathologists who generously volunteered to serve as voice clinicians: Mahdis Adams, Davette W. Butcher, Susie Durr, Judy Giordano-Olson, Kim Player, Patricia Smith, Kristine Tanner, Joan Townsend, and Lorilyn K. Vogel. Without their assistance this research would not have been possible. The authors also gratefully acknowledge the assistance and support of Dale Sheld, Education Specialist for Communication Disorders and Learning Disabilities, and the coordinators of the speech-language pathology programs of the Utah State Office of Education. We would like to thank Dennis Heisey, Department of Surgery, University of Wisconsin-Madison, for his helpful comments and advice regarding statistical analyses. This work was supported in part by the National Center for Voice and Speech through Grant R01-DC02285-01A1 (Voice abuse in teachers and the general population) of the National Institute on Deafness and Other Communication Disorders.

References

- Andrews, M. L. (1995). *Manual of voice treatment: Pediatrics through geriatrics*. San Diego, CA: Singular.
- Boone, D. R., & McFarlane, S. C. (2000). *The voice and voice therapy* (6th ed.). Boston: Allyn and Bacon.
- Broaddus-Lawrence, P. L., Treole, K., McCabe, R. B.,

- Allen, R. L., & Toppin, L.** (2000). The effects of preventive vocal hygiene education on the vocal hygiene habits and perceptual characteristics of training singers. *Journal of Voice*, 14, 58–71.
- Case, J. L.** (1996). *Clinical management of voice disorders* (3rd ed.). Austin, TX: Pro-Ed.
- Chan, R. W.** (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.
- Colton, R., & Casper, J. K.** (1996). *Understanding voice problems: A physiological perspective for diagnosis and treatment*. Baltimore: Williams & Wilkins.
- Frederic, A., Pugliano, J. F., & Piccirillo, J. F.** (1999). Outcomes research [CD-ROM]. In C. W. Cummings, J. M. Fredrickson, L. A. Harker, C. J. Krauss, M. A. Richardson, & D. E. Schuller (Eds.), *Otolaryngology-Head and Neck Surgery* (Vol. 1, 3rd ed.). St. Louis, MO: Mosby.
- Fritzell, B.** (1996). Voice disorders and occupations. *Logopedics, Phoniatrics, and Vocology*, 21, 7–12.
- Gotaas, C., & Starr, C. D.** (1993). Vocal fatigue among teachers. *Folia Phoniatrica*, 45, 120–129.
- Herrington-Hall, B. L., Lee, L., Stemple, J. C., Niemi, K. R., & McHone, M. M.** (1988). Description of laryngeal pathology by age, sex, and occupation in a treatment-seeking sample. *Journal of Speech and Hearing Disorders*, 53, 57–54.
- Jacobson, B. H., Johnson, A., Grywalski, C., Silbergleit, A., Jacobson, G., Benninger, M. S., & Newman, C. W.** (1997). The Voice Handicap Index (VHI): Development and validation. *American Journal of Speech-Language Pathology*, 6(3), 66–70.
- Koschkee, D. L., & Rammage, L.** (1997). *Voice care in the medical setting*. San Diego, CA: Singular.
- Mattiske, J. A., Oates, J. M., & Greenwood, K. M.** (1998). Vocal problems among teachers: A review of prevalence, causes, prevention, and treatment. *Journal of Voice*, 12, 489–499.
- Morrison, M., Rammage, L., Nichol, H., Pullan, B., May, P., & Salkeld, L.** (1994). *The management of voice disorders*. San Diego, CA: Singular.
- Pekkarinen, E., Himberg, L., & Pentti, J.** (1992). Prevalence of vocal symptoms among teachers compared with nurses: A questionnaire study. *Scandinavian Journal of Logopedics and Phoniatrics*, 17, 112–117.
- Pekkarinen, E., & Viljanen, V.** (1991). Acoustic conditions for speech communication in classrooms. *Scandinavian Audiology*, 20, 257–263.
- Prater, R. J., & Swift, R. W.** (1984). *Manual of voice therapy*. Austin, TX: Pro-Ed.
- Rantala, L., Haataja, K., & Vilkman, E.** (1997). Measuring voice under teachers' working circumstances: F_0 and perturbation features in maximally sustained phonation. *Folia Phoniatrica and Logopedics*, 49, 281–291.
- Rantala, L., Paavola, L., Korkko, P., & Vilkman, E.** (1998). Working-day effects on the spectral characteristics of teaching voice. *Folia Phoniatrica and Logopedics*, 50, 205–211.
- Russell, A., Oates, J., & Greenwood, K. M.** (1998). Prevalence of voice problems in teachers. *Journal of Voice*, 12, 467–479.
- Sabol, J. W., Lee, L., & Stemple, J. C.** (1995). The value of vocal function exercises in the practice regimen of singers. *Journal of Voice*, 9, 27–36.
- Sapienza, C. M., Crandell, C. C., & Curtis, B.** (1999). Effects of sound-field frequency modulation amplification on reducing teacher's sound pressure level in the classroom. *Journal of Voice*, 13, 375–381.
- Sapir, S., Keidar, A., & Mathers-Schmidt, B.** (1993). Vocal attrition in teachers: Survey findings. *European Journal of Disorders of Communication*, 28, 177–185.
- Saxon, K. G., & Schneider, C. M.** (1995). *Vocal exercise physiology*. San Diego, CA: Singular.
- Smith, E., Gray, S. D., Dove, H., Kirchner, H. L., & Heras, H.** (1997). Frequency and effects of teachers' voice problems. *Journal of Voice*, 11, 81–87.
- Smith, E., Kirchner, H. L., Taylor, M., Hoffman, H., & Lemke, J. H.** (1998). Voice problems among teachers: Differences by gender and teaching characteristics. *Journal of Voice*, 12, 328–334.
- Smith, E., Lemke, J., Taylor, M., Kirchner, H. L., & Hoffman, H.** (1998). Frequency of voice problems among teachers and other occupations. *Journal of Voice*, 12, 480–488.
- Stemple, J.** (2000). *Voice therapy: Clinical studies* (2nd ed.). San Diego, CA: Singular.
- Stemple, J., Glaze, L., & Klaben, B.** (2000). *Clinical voice pathology: Theory and management* (3rd ed.). San Diego, CA: Singular.
- 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, 271–278.
- Titze, I. R., Lemke, J., & Montequin, D.** (1997). Populations in the U.S. workforce who rely on voice as a primary tool of trade: A preliminary report. *Journal of Voice*, 11, 254–259.
- 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, 30–47.
- Verdolini, K., Titze, I. R., & Fennell, A.** (1994). Dependence of phonatory effort on hydration level. *Journal of Speech and Hearing Research*, 37, 1001–1007.
- Verdolini-Marston, K., Titze, I. R., & Druker, D. G.** (1990). Changes in phonation threshold pressure with induced conditions of hydration. *Journal of Voice*, 4, 142–151.

Received July 17, 2000

Accepted November 1, 2000

DOI: 10.1044/1092-4388(2001/023)

Contact author: Nelson Roy, PhD, Department of Communication Disorders, 390 South 1530 East, Room 1219, Salt Lake City, UT 84112-0252.

Appendix A. Vocal hygiene program.

Clearing your throat or coughing habitually might damage the vocal fold tissues.

Instead: Try some of these substitute behaviors.

- Yawn to relax your throat.
- Swallow slowly and deliberately.
- Sip water, let your throat relax for a second, and then resume speaking.
- Use the “silent cough” technique.
- Hum: concentrate on vocal resonance sensations.
- If necessary, suck on candy (NOT cough drops with menthol or mint).
- Be particularly aware of the throat clearing habit during lecturing.

Speaking loudly, yelling, cheering, or screaming might damage the vocal fold tissues.

Instead:

- Use gestures, nonvocal sounds, or instruments to attract attention from a distance (for example: clap, whistle, ring a bell, blow a horn).
- Set up a system of nonvocal signals with students to get their attention and maintain discipline. If you must speak to a student who is behaving undesirably, walk up to them and speak to them quietly. (This is sometimes more effective than yelling). Apply these principles to your own children and pets.

Speaking over loud noise for a long period of time can cause vocal fatigue or increased laryngeal tension. Noisy situations include classroom noise, loud music, televisions, parties, restaurants, cars, buses, airplanes, and so on.

Instead:

- Try to reduce background noise during conversations (e.g., turn off loud music or television).
- Wait until students/audience are quiet and attentive.
- Choose quiet restaurants, booths, or tables in the corner.
- Face your conversational partner.
- Reduce the distance between you and your conversational partner so you can be heard without yelling.
- Position yourself so your face is well lighted.
- Overarticulate.
- Practice your listening.

Prolonged use of unconventional vocal sounds—whispering, growls, squeaks, imitating animals, or machine noises—can harm vocal fold tissues.

Instead:

- If you must produce special vocal effects for performance, make sure you are using a technique that minimizes muscle tension and vocal abuse.

- Be especially aware to avoid using such unconventional sounds during oral reading to your students.

If you sing—you should know that singing beyond your comfortable pitch and loudness range can irritate the vocal folds.

Instead:

- Know your limits for pitch and loudness.
- Avoid forcing your voice to stay in a register beyond its comfortable pitch range. Don't force your “chest voice” too high; and don't force your “head voice” high into falsetto range. Allow vocal registers to change with pitch.
- Avoid singing all parts if you teach choral music; use instrumental demonstrations instead.
- Seek professional voice training.
- Never sing a high note that you can't sing quietly; don't push beyond comfortable pitch in any register.

Talking with a low-pitched monotone voice and allowing vocal energy to drop so low that the voice becomes rough and gravelly (i.e., “glottal fry”) can be potentially harmful to your voice.

Instead:

- Keep your voice powered by breath flow, so the tone carries, varies, and rings.
- Try not to speak beyond the natural breath cycle by squeezing out the last few words without sufficient breath.
- Speak slowly, pause at natural phrase boundaries, and take another breath before running out of air.
- Allow pitch to vary freely and expressively; keep pitch comfortable.

Holding your breath as you're planning what to say can lead to hard glottal attacks—sudden tense initiation of voice or aggressive or low-pitched fillers, such as um... or ah..., should be avoided.

Instead:

- Initiate voice gradually and easily.
- Keep the shoulders, upper chest, neck, and throat relaxed as you begin speaking.
- Use the breathing muscles and airflow to start speech phrases.
- Avoid tightening upper chest, shoulders, neck, or throat to push the voice out.
- Let your abdomen and rib cage move freely.
- Avoid clenching your teeth, or tensing your jaw or tongue during speech.

Speaking extensively during strenuous physical exercise is not recommended.

Instead:

- After aerobic exercise, wait until your breathing system can accommodate optimal voice production.
- Avoid loud and aggressive vocal “grunts” while exercising.

Your general health can affect your voice. Maintain a healthy lifestyle and a healthy environment.

- Do not smoke. If you smoke, see your family doctor about ways to stop smoking—seek a referral to a smoking cessation clinic. Avoid spending large amounts of time in dry, smoke-filled environments.
- Avoid recreational drugs.
- Avoid caffeinated beverages such as coffee, tea, and colas.
- Monitor/reduce alcohol intake. Alcohol can have a drying effect on vocal fold tissues.
- Maintain a well-balanced diet.
- Get adequate sleep—7 to 8 hours per night.
- Maintain proper humidity. A small portable vaporizer at the bedside is often helpful at night. Purchasing a room humidifier may be an option, especially if your home or work environment is extremely dry or dust-filled. Environmental levels of humidity should be at least 30%.
- Maintain proper hydration. Drink 8 to 10 glasses of decaffeinated fluids per day. Water is the preferred fluid. Have it handy at all times and sip it throughout the day, especially while teaching.

- Some medications, including antihistamines and decongestants, can cause increased dryness of tissues, causing a dry, scratchy feeling in the throat. Be aware of this and compensate with increased hydration (i.e., fluid consumption). If possible, reduce the use of such medications.

Reduce your total amount of voice use.

- Rest your voice when you are tired or have an upper respiratory infection (i.e., cold or flu-like symptoms). Do not force your voice when it is hoarse because of a cold.
- Rest your voice before it becomes fatigued—before tightness, dryness, or hoarseness is noticed. Schedule your day so that there are periods of voice rest interspersed. If you don’t have to, don’t schedule your classes back to back. Don’t spend your lunch talking with other teachers; use that time to be quiet and rest your voice. Curtail your voice use socially.
- When getting involved in extracurricular activities, consider how much voice use will be required. If it is great, you may want to consider choosing another activity or becoming involved in another capacity.
- Change your style of teaching. Make use of audiovisual materials, desk-work, student presentations, and small group formats to reduce the amount of constant talking. Make use of student teachers, teaching assistants, and volunteer parents whenever possible.

Appendix B. Vocal Function Exercise Program.

Four specific exercises are performed *two times each, twice daily (morning and evening)* for 6 weeks.

Exercise 1 - “Warm-up exercise” - sustain vowel /i/ as long as possible

- Women on musical note (F) above middle C
- Men on musical note (F) below middle C
- Extreme forward focus “almost but not quite nasal”

Goal - sustained /i/ equal to length of maximum sustained /s/

Exercise 2 - “Stretching exercise” - Glide upward from your lowest to your highest note on the word “knoll”

- You may also use tongue or lip trill, or the word “whoop” (emphasis is on forward placement, open pharynx, sympathetic vibration on lips)

Goal - No voice breaks during upward pitch glide.

Exercise 3 - “Contracting exercise” - Glide downward from your highest to your lowest note on the word “knoll”

- Focus on half-yawn in the throat (“*papa bear voice*”)—pharynx open—slow, systematic *without growl* at the bottom—no muscling of the tone allowed—may use lip trill, tongue trill, or the word “boom”

Goal - No voice breaks during downward pitch glide.

Exercise 4 - “Low impact adductory power exercise” - Sustain the musical notes (C-D-E-F-G) for as long as possible on the word “knoll” minus the “kn”

- Middle C for women, octave below middle C for men
- Focus on open pharynx and constricted vibrating lips

Goal - same as Exercise 1 (i.e., as long as maximum sustained /s/ production).

Important Principles of Vocal Function Exercises:

- All exercises are produced as softly as possible—but the voice is engaged, not breathy. No hard glottal attack at initiation of phonation.
 - It is very important that the placement of the tone is *forward* (constricted, sympathetically vibrating lips) and pharynx is *open* (i.e., inverted megaphone shape).
 - Specific speech stimuli are selected to help achieve placement of the tone and pharyngeal opening (i.e., knoll, oll).
 - The tone should not be muscled at the larynx; rely on interaction between abdominal contraction and breath support.
 - Practice consistency is encouraged; the subject charts progress on a graph or voice record sheets, and audiotapes are provided to guide practice sessions.
-

Appendix C. Posttreatment Questionnaire.

Read each question and then circle the number that indicates your *honest* assessment.

1. To what extent did this treatment improve your voice symptoms?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot

2. To what extent did this treatment make your voice clearer?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot

3. To what extent did this treatment make it easier to talk and/or sing?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot

4. To what extent did you comply with the treatment program?

1	2	3	4	5
Not at all	Very little	Somewhat	Quite a bit	A lot
