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TREATMENT FOR TEACHERS WITH VOICE DISORDERS:
AN EVIDENCE-BASED REVIEW

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Treatment for Teachers with Voice Disorders: An Evidence-Based Review

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Clinical Scenario

Melanie, a speech-language pathologist (SLP) who serves two schools (a middle school and a high school) in a rural county, was recently approached by a female high school teacher after a faculty meeting. The teacher reported that the students consistently tell her they cannot hear her. Knowing this, she had attempted to increase her loudness level. However, the teacher noticed that by the end of the day, she had almost lost her voice or was very hoarse. The teacher asked the SLP if there was anything that could be done. The SLP explained the vocal abuse that was occurring and recommended a laryngoscopic examination by an ear, nose, and throat (ENT) physician to rule out a physiological reason for the symptoms the teacher was describing. The teacher reported that she has an unremarkable history and lifestyle in that she does not smoke or drink alcohol, she exercises three to four times a week, and she drinks no more than two caffeinated drinks a day (coffee, tea, or soda). But she did agree to see the ENT.

The Clinical Question

Several days later, the teacher reported to Melanie that the ENT had diagnosed her with bilateral vocal nodules, and she asked for help on improving her voice use in the classroom. The SLP indicated that she believed voice therapy would be beneficial, but she wanted to review the literature on the best approach. Melanie gave the teacher several questions to answer, such as how long have the symptoms been occurring, how many students are in her class, and how much extraneous noise is present while teaching. In addition to finding an evidence-based treatment, the SLP knew that these are factors that should be taken into consideration when treating the teacher's voice disorder. Melanie then delved into the literature to address this clinical question: Is treatment of voice problems for teachers effective? Using the PICO framework for preparing evidence-based questions, the purpose of this brief is to establish recommendations for prevention and

treatment of voice problems of teachers derived from an evidence-based review of the relevant literature.

Clinical Background and Justification

Teachers are at high risk for voice problems, with as many as 50% of teachers experiencing voice problems and vocal abuse related to extensive voice use and classroom conditions, such as excessive noise levels and poor ventilation (Mattiske, Oates, & Greenwood, 1998; Sapir, Keidar, & Mathers-Schmidt, 1993; Thibeault, Merrill, Roy, Gray, & Smith, 2004). Both female and male teachers report more voice problems than persons in other professions (Smith, Gray, Dove, Kirchner, & Heras, 1997); however, female teachers more often report voice problems than male teachers (Simberg, Sala, Vehmas, & Laine, 2005; Smith, Kirchner, Taylor, Hoffman, & Lemke, 1998). Voice problems may increase because of larger size classes and factors that disturb normal classroom routines, such as noisy or misbehaving students (Simberg et al.). These factors could increase background noise and stress, thus increasing the risk for teachers' voice problems. Prior to examining the empirical literature regarding treatment approaches for voice problems in teachers, Melanie sought to develop a greater background understanding of voice disorders among teachers.

As many as 50% of teachers experience voice problems and vocal abuse.

Voice symptoms. The most frequently reported voice problems among teachers are hoarseness, vocal fatigue, increased effort to speak, loss of voice, voice breaks, and physical discomfort, such as laryngeal pain or tension (Roy, Merrill, Thibeault, Gray, & Smith, 2004; Simberg, Sala, & Ronnema, 2004). Teachers often report multiple symptoms of a voice problem (Sapir et al., 1993; Simberg, Laine, Sala, & Ronnema, 2000).

Gender. Both female and male teachers report more voice problems than persons in other professions (Smith

et al., 1997). However, female teachers more often report having voice problems than male teachers (Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, & Preciado-Ruiz, in press; Simberg et al., 2005). For example, Roy, Merrill et al. (2004) reported that females have a higher prevalence of voice problems (46% female to 30% male) but also a higher prevalence of chronic rather than acute voice problems (20% versus 13%). Furthermore, female teachers have organic lesions three times more often than males (Preciado-Lopez et al.).

Etiology. Voice problems in teachers are most frequently associated with vocal nodules, gastroesophageal reflux, and chronic respiratory problems. These problems may also be related to smoking, use of alcohol, and auditory problems, such as hearing loss and tinnitus (Tavares & Martins, 2007; Thomas, DeJong, Cremers, & Kooijman, 2006). Although teachers appear to be less likely to use alcohol and tobacco products, they report more voice problems (Roy, Merrill et al., 2004).

Environment. The primary environmental factors related to voice problems in teachers are prolonged voice use in poor working conditions, such as noisy and poorly ventilated classrooms. Many classrooms are acoustically inadequate (i.e., do not meet minimal acoustic standards for adequate learning). Thus, it is necessary to monitor noise levels and possibly use amplification systems. In addition, teachers may be more frequently exposed to upper respiratory infections and other airborne irritants (DeMadeinos, Barreto, & Ascincod, in press; Roy et al., 2002).

Professional performance. Voice problems have a negative impact on professional performance, attendance, and retention. Teacher's voice problems are detrimental to student performance, regardless of the student's gender and school attended. Teacher's voice problems can be detrimental to children's speech processing and thus have a negative educational impact. Moreover, these children are educationally disadvantaged because processing of spoken language is disrupted (Rogerson & Dodd, 2005). Teachers who have voice problems miss more work days and are more likely to change occupations (Roy, Merrill et al., 2004).

Career status. Students in training to be teachers frequently have voice problems related to excessive vocal use and vocal fatigue (Gottliebson, Lee, Weinrich, & Sanders, 2007; Thomas, Kooijman, Donders, Cremers, & DeJong, 2007). Beginning teachers are not prepared to deal with the vocal demands of teaching (Tavares & Martins, 2007),

and teachers who had voice problems during student training reported more voice problems during their careers. Interestingly, teachers have more voice complaints early in their career than at the end of their career (Kooijman et al., 2006). On the other hand, Yiu (2002) found that "practicing teachers perceived their voice to be significantly worse than prospective teachers" (p. 215).

Psychosocial issues. Depression, anxiety, and mood swings have been reported in teachers with voice problems as precipitating and/or perpetuating factors (Aronson, 1990). The Voice Handicap Index (VHI) by Jacobson and associates (1997) has been used to quantify the psychosocial impact of voice problems in teachers (Bovo, Galceran, Petruccelli, & Hatzopoulos, 2007; Kooijman, DeJong et al., 2005, 2006; Kooijman, Thomas, Graamans, DeJong, 2007). Both student teachers and teachers with voice problems had higher VHI scores (i.e., a greater voice handicap). Teachers with Type D personality, who exhibit more negativity and social inhibition, had higher VHI scores (Thomas, DeJong, Kooijman, & Cremers, 2006).

Treatment status. The percentage of teachers who actually seek assessment or treatment of voice problems is substantially lower than the number of teachers with voice problems (Roy, Merrill et al., 2004). There may be a number of reasons for this: not wanting to take time off from work; fear about redirecting voice uses; negative perception by peers; concerns about the need to change occupations; and being unaware of resources for assessment and treatment of voice problems (Gillivan-Murphy, Drinnan, O'Dwyer, Ridha, & Carding, 2006). It is common for persons with voice problems to not adhere to recommendations for voice treatment (Portone, Johns, & Hapner, 2008).

Search for Evidence

With this background information in mind, Melanie completed a thorough literature search on treatments for voice disorders. To be selected for inclusion, a study was required to be data-based, to have been published in a peer-reviewed journal, and to focus on treatment of voice problems in teachers. Studies for this review were collected by hand and electronic searches. A search was conducted using electronic databases (MEDLINE, CINAHL) and books relevant to the topic. Reference lists of studies retrieved from the electronic and hand searches were reviewed for additional studies. In total, Melanie found 10 studies that met the inclusion criteria. In the 10 studies, a total sample of 395 teachers participated (see Table 1).

The SLP conducted a critical analysis of 10 studies that met her inclusion criteria.

Melanie conducted a critical analysis to determine the relative strengths of the studies using criteria such as study design, sampling, subjects, and outcomes (Mullen, 2007) (see Table 2). For each study, the criteria were examined using the Law, Garrett, and Nye (2004) three-point scale: I= inadequate, U= unclear, and A= adequate. A rating of “adequate” on five or more criteria indicated good quality, while fewer than five ratings of “adequate” signified poor quality. In regards to meeting the criteria for levels of evidence, one study met all of the criteria. The other studies met 10% to 80% of the criteria. None of the studies met the criteria for blinding, and only two studies mentioned intention to treat (Roy et al., 2003) or precision (effect size) (McCabe & Titze, 2002). It is important to recognize that all criteria are not equal in importance (Gillam & Kamhi, 2007). Some factors are more important than others, particularly with respect to establishing causality. In this regard, a randomized, controlled trial offers the greatest precision. An analysis of the studies in terms of level of support was used to organize the body of work into those with strong support, moderate support, and limited support (see Table 3).

Evaluating the Evidence

Six of the ten studies provided strong support for treatment of voice problems in teachers (see Table 3). The other four studies provided limited to moderate evidence (Levels III and IIa). These levels of evidence are stronger because the studies were well-designed and may include a control and experimental group (American Speech-Language-Hearing Association [ASHA], 2004a). One of the treatment studies (Roy et al., 2002) was reviewed by Dworkin, Abkarian, Stachler, Culatta, and Meleca (2004), which identified several flaws. Among these flaws were participant selection criteria, perceptual ratings by participants, and questionable statistical analyses. Roy, Weinrich, Tanner, Corbin-Lewis, and Stemple (2004) responded that many of these issues were considered in a later republication study (Roy et al., 2003). Furthermore, it should be noted that this study was randomized and controlled, which is considered high-level/credible evidence supporting the use of vocal function exercises . . . “as a useful alternative or adjunct to vocal hygiene programs in the treatment of voice problems in teachers” (p. 286).

Melanie wanted to identify the specific treatments used. Table 4 summarizes the treatments and outcome measures. Vocal hygiene was the most frequently used treatment method, examined in five of the ten studies. Several studies used a combination of two or more treatments (e.g., vocal exercises and vocal hygiene; resonance therapy and respiratory muscle training). Although the level of evidence (ASHA, 2004b) was not strong for all studies, greater improvement seemed to be associated with the following treatments: vocal care/hygiene, vocal exercises, vocal amplification, respiratory training, and/or resonance therapy. Vocal hygiene was not found to be effective in one study (Roy et al., 2002) and chant therapy was only potentially effective in reducing vocal fatigue (McCabe & Titze, 2002).

A variety of clinical and instrumental outcome measures were used. The most common outcome measure, used in five of the studies, was acoustic analysis (e.g., Computerized Speech Lab [CSL], Kay 4300B; Kay Elemetrics Corporation) followed by the VHI. Only three studies reported visualization of the larynx (stroboscopy or endoscopy), although laryngeal status and structure, and function of the laryngeal area, are critical factors in prognosis and treatment of voice problems (Colton, Casper, & Leonard, 2005; Haynes & Pindzola, 2003).

Evidence-Based Decision

Evidence-based practice requires that speech-language pathologists apply qualitative and quantitative research to make clinical decisions. Melanie found that the results of her evidence-based review supported a range of treatment options to address the voice problems of teachers; in turn, positive impacts can be realized for teachers, students, and the school. Specifically, the teacher has fewer absences, which reduces the cost of absences for the school, teacher and student classroom performance is positively facilitated, and the students can better understand the teacher’s instructions (Rogerson & Dodd, 2005).

Based on her review, Melanie decided to develop

Vocal hygiene was the most frequently used treatment method in the 10 studies, although one study did not find vocal hygiene effective.

The SLP recommended a treatment plan of vocal hygiene and sound field amplification to the teacher.

a treatment plan for the teacher. The intervention plan would include vocal hygiene and use of a sound field amplification system. Because the teacher did not smoke, drink, or consume large amounts of caffeine, the vocal hygiene strategies included drinking water to keep the vocal folds hydrated and using an appropriate loudness level that also included using the amplification system for lecturing. It was determined that treatment would be implemented for a period of four months followed by reassessment. Melanie's prior recommendation for the direct examination by an ENT was appropriate, but another measure was needed to study change over time during treatment. Being in a rural county, there was no access to equipment for acoustic measurements, so she chose to administer the VHI. Additionally, Melanie decided to initiate a prevention program for all teachers in the schools in which she works. For these activities, Melanie organized a set of notes regarding voice problems in teachers that she assembled during her review process (see Appendix). Melanie will be working closely with administrators to disseminate prevention-oriented information to advise teachers how to care for their voices and prevent vocal abuses in their classrooms.

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Appendix: Voice Problems in Teachers

The Facts
<ul style="list-style-type: none"> – Failure to recognize voice problems in teachers can create an occupational hazard. – Incidence of voice problems in teachers is greater than 50%. – Female teachers are at greater risk for voice problems than male teachers. – Incidence of voice problems in teachers is predicted to increase with larger classes and related circumstances. – Approximately 20% of student teachers have voice problems. – The most frequent voice complaints are hoarseness and vocal fatigue. – Common environmental factors: classroom acoustics and noise, indoor air, exposure to upper respiratory infections, classroom cleanliness. – The cost of voice problems in teachers is considerable, about \$2.5 billion annually in the United States, primarily due to absenteeism and poor teacher performance (Verdolini & Ramig, 2001). – Related medical conditions: gastroesophageal reflux, vocal nodules, laryngitis. – Voice problems cause a negative impact on attendance and retention: more absences on work days, more likely to change professions. – Psychosocial factors, depression, anxiety, and mood swings perpetuate voice problems.
Strategies for Risk Education
<ul style="list-style-type: none"> – Advise teachers and school administrators about risks of voice problems in teachers and availability of prevention and treatment programs. – Voice care and hygiene are critical components for prevention and treatment of voice problems (Fletcher, Drinnan, & Carding, 2007). – Facilitate access to voice programs (e.g., private agencies, university programs). – Develop guidelines and follow-up on control of environmental risks, such as classroom noise/acoustics. – Periodic laryngeal examinations (Tavares & Martins, 2007). – Annual voice screening because of the high prevalence of voice problems among teachers (Preciado-Lopez et al., in press). – Adequate explanation of vocal demands for future teachers and for starting teachers. – Investigate voice care knowledge among teachers and school administrators; these findings have potential implications for awareness and educational programs (Fletcher, Drinnan, & Carding, 2007). – Use evidence-based voice treatment strategies: vocal hygiene (Chan, 1994; Duffy & Hazlett, 2004; Roy et al., 2001, 2002); vocal function exercises (Bovo et al., 2007; Gillivan-Murphy et al., 2006; Roy et al., 2001); resonant voice therapy (Chen et al., 2007; Roy et al., 2003); respiratory muscle training (Roy et al., 2003); and chant therapy (McCabe & Titze, 2002). – Increase access to technology that facilitates diagnosis and treatment, such as amplification (Roy et al., 2002; Roy et al., 2003) and the Ambulatory Phonation Monitor (Kaypentax, 2007).

Table 1. Overview of 10 Treatment Studies

Study	Evidence Level ¹	Design	Sample	Intervention	Outcome/Results
Bovo, Galceran, Petruccelli, Hatzopoulos (2007)	Ib	Randomized, controlled	21 female teachers out of 264 who attended the preventive courses; 20 teachers were matched as a control group	Attended voice care course: 120 minutes of theoretical seminar & 180 minutes (small groups) of voice group therapy. This was followed by three months of attending vocal ergonomics norms and reporting on daily vocal abuse, and complete exercises for efficient vocal technique and report whether time scheduled was respected.	Used stroboscopy, perceptual and electro-acoustical analysis (included global grade of dysphonia score), VHI, and course benefit questionnaire. Pretest and three-month evaluation. Acoustic measurements, VHI, MPT, and global score showed significant improvement. 12-month assessment showed positive effects but slightly reduced. Concluded a course with two lectures, group voice therapy, voice exercises, and hygiene were a cost-effective primary prevention of voice disorders.
Chan (1994)	IIa	Controlled, but not randomized	12 experimental K teachers; 13 control group K teachers	Vocal hygiene workshop (1.5-hour workshop and practice of hygiene for two months)	Used acoustic (perturbation; long-time average spectrum, and EGG [DC]) as measurement. Significant improvement for acoustic measurements and EGG. No significant change for control group. Implications: voice can be improved by reducing daily vocal abuses, practicing strategies to maintain order, and reducing use of voice.

continued

Table 1., continued

Study	Evidence Level ¹	Design	Sample	Intervention	Outcome/Results
Chen, Hsiao, Hsiao, Chung, Chiang (2007)	IV	Prospective study with experimental group; no control	24 female voice-disordered teachers (Taiwan)	All received resonance voice therapy in groups of four; 90-minute sessions; one session/week for eight weeks	Used perceptual judgment, videostroboscopic exam and acoustic, aerodynamic, and functional (VHI) measurements. Resonance therapy had positive effects on voice quality, vocal fold vibration, vocal fold closure, speaking flexibility, phonation effort, and functional communication. Perturbation and breathiness did not change, but these were close to normal at pre-test.
Duffy, Hazlett (2004)	Ib	Randomized, controlled	55 training teachers	23 control group; 20 indirect (information provided); 12 direct (training, modifying behaviors; focused on posture respiration, resonance)	Used acoustic measurement and VHI. No significant results, but measurements showed deterioration for the control group, no change for the indirect group, and improvement for the direct group.
Gillivan-Murphy, Drinnan, O'Dwyer, Ridha, Carding (2006)	Ib	Randomized, controlled	20 teachers with self-reported voice problems	11 received no treatment; 9 received vocal function exercises (VFE) and vocal hygiene (VH)	All received fiberoptic endoscope; two self-report voice outcome measures (VRQOL & VoiSS) and voice care knowledge (VAS) were used. Significant changes ($p < 0.05$) for treatment group on VoiSS and VAS; therefore, voice treatment approach improved self-reported voice symptoms (VoiSS) and voice care knowledge (VAS).

continued

Table 1., continued

Study	Evidence Level ¹	Design	Sample	Intervention	Outcome/Results
McCabe, Titze (2002)	III	Multiple baseline, alternating design	Four public school teachers with history of vocal fatigue	Chant therapy and placebo therapy used in multiple baseline across subjects design	Voice Range Profile (VRP) used as measurement of speaking pitch. Chant therapy is potentially effective for remediation of vocal fatigue.
Roy, Gray, Simon, Dove, Corbin-Lewis, Stemple (2001)	Ib	Randomized, controlled	58 voice-disordered teachers	20 received vocal hygiene; 19 received vocal function exercises; 19 received no treatment; Six weeks of therapy	Voice Handicap Index (VHI) used for pre/post testing. Significant reduction in mean VHI score for vocal function exercise group ($p < .0002$); this group exhibited overall voice improvement ($p < .05$), greater ease ($p < .02$) and clarity ($p < .01$) in speaking and singing voice. VFE is recommended as alternative or adjunct to vocal hygiene.
Roy, Weinrich, Gray, Tanner, Stemple, Sapienza (2003)	IIb	Randomized	64 voice-disordered teachers	25 received voice amplification (ChatterVox); 19 received resonance therapy; 20 received respiratory muscle training; Six weeks treatment	VHI and voice severity self-rating scale used for pre & post testing. VA and RT groups reported significant reductions with both measurements (i.e., mean of VHI scores; severity self-rating); RT suggested as effective treatment alternative.

continued

Table 1., continued

Study	Evidence Level ¹	Design	Sample	Intervention	Outcome/Results
Roy, Weinrich, Tanner, Toledo, Dove, Corbin-Lewis, Stemple (2002)	Ib	Randomized, controlled	44 voice-disordered teachers	15 received voice amplification with ChatterVox; 15 received vocal hygiene; 14 received no treatment; Six weeks of treatment	VHI, self-rating scale, and speech sample for acoustic analysis used for pre & post testing. Voice amplification showed significant changes in all three measures; nontreatment group's VHI handicap increased. No significant improvement for VHI group.
Simberg, Sala, Tuomainen, Sellman, & Ronnema (2006)	Ib	Randomized, controlled	40 student teachers with mild voice disorder (> 2 reported vocal by symptoms/ week or obvious deviant voice quality; 20 in experimental group; 20 in control group)	All received lecture on voice ergonomics, then groups randomly chosen. Experimental group received seven 90-minute voice therapy sessions in small groups (6–8 per group). Received direct (modifications of vocal rehabilitation exercises with “resonance tube” and accent method – emphasis on diaphragmatic breathing, rhythmic vowel production, voiced bilabial fricative exercises) and indirect (voice ergonomics)	Perceptual evaluation, questionnaire on occurrence of vocal symptoms, and laryngeal status (by ENT) used as measurements. Perceptual measures and questionnaire (self-reported) were significantly better. No significant findings for laryngeal status. Questionnaire showed significant differences one year post study.

¹ Levels based on American Speech-Language-Hearing Association (2004b) whereby Ia = Strongest (well-designed meta-analysis of >1 randomized, controlled trial); Ib = Strong (well-designed, randomized, controlled trial); IIa = Moderate (well-designed, controlled study without randomization); IIb = Moderate (well-designed, quasi-experimental study); III = Limited (nonexperimental studies, e.g., correlational and case studies); IV = Weak (opinion of authorities, clinical experience).

Table 2. Evaluation of Quality for Each Study Based on Mullen's Criteria (2007)

	Criteria ¹							
	Study Design	Blinding	Sampling	Subjects	Outcomes	Significance	Precision	Intention to Treat
Bovo et al. (2007)	A	I	I	A	A	A	I	I
Chan (1994)	A	I	I	A	A	A	I	I
Chen et al. (2007)	I	I	I	I	I	A	I	I
Duffy & Hazlett (2004)	A	I	A	A	A	A	I	I
Gillivan-Murphy et al. (2006)	A	I	A	A	A	A	I	I
McCabe & Titze (2002)	I	I	I	I	I	A	A	I
Roy et al. (2001)	A	I	A	A	A	A	I	I
Roy et al. (2003)	A	I	A	A	A	A	I	A
Roy et al. (2002)	A	I	A	A	A	A	I	I
Simberg et al. (2006)	A	I	I	A	A	A	I	I

¹ Rating based on Law, Garrett, and Nye (2004) for which I=inadequate; U=unclear; A=adequate.

Table 3. Studies Differentiated by Levels of Evidence

Strong support (Evidence Level Ia or Ib)	Bovo, Galceran, Petruccelli, & Hatzopoulos (2007) Duffy & Hazlett (2004) Gillivan-Murphy, Drinnan, O'Dwyer, Ridha, & Carding (2006) Roy, Gray, Simon, Dove, Corbin-Lewis, & Stemple (2001) Roy, Weinrich, Gray, Tanner, Toledo, Dove, Corbin-Lewis, & Stemple (2002) Simberg, Sala, Tuomainen, Sellman, & Ronnema (2006)
Moderate support (Evidence Level IIa or IIb)	Chan (1994) Roy, Weinrich, Gray, Tanner, Stemple, & Sapienza (2003)
Limited support (Evidence Level III or IV)	Chen, Hsiao, Hsiao, Chung, & Chiang (2007) McCabe & Titze (2002)

Table 4. Summary of Treatment Approaches for Addressing Teacher's Voice Problems

	Amplification	Chant Therapy	Group Therapy	Resonant Therapy	Respiratory Muscle Training	Vocal Function Exercises	Voice Care/ Vocal Hygiene
Bovo et al. (2007)						X	X
Chan (1994)							X
Chen et al. (2007)				X			
Duffy & Hazlett (2004)							X
Gillivan-Murphy et al. (2006)						X	
McCabe & Titze (2002)		X					
Roy et al. (2001)						X	X
Roy et al. (2002)	X						X
Roy et al. (2003)	X			X	X		
Simberg et al. (2006)			X			X	