

EBP *briefs*

A scholarly forum for guiding evidence-based
practices in speech-language pathology

BEHAVIORAL VOICE THERAPY IN SCHOOL-AGE
CHILDREN WITH VOCAL FOLD NODULES

CHRISTOPHER R. WATTS

EBP Briefs

Editor

Chad Nye
University of Central Florida

Editorial Review Board

Barbara Moore
Anaheim Unified School District

Anita McGinty
University of Virginia

Chris Watt
Texas Tech University

Cynthia O'Donohue
James Madison University

Jamie Schwartz
University of Central Florida

Jennifer Kent-Walsh
University of Central Florida

Jill Rentmeister
University of Wisconsin

Julie Wolter
Utah State University

Kelly Shussler Ferguson
The Ohio State University

Kim Murza
University of Central Florida

Laura Justice
The Ohio State University

Lisa Bedore
University of Texas

Mary Beth Schmitt
The Ohio State University

Miram Boesch
Purdue University

Monique Mills
The Ohio State University

Tim Meline
Lamar University

Managing Director

Tina Eichstadt
Pearson
5601 Green Valley Drive
Bloomington, MN 55437

Cite this document as:

Watts, C. R. (2012). Behavioral voice therapy in school-age children with vocal fold nodules. *EBP Briefs*, 6(5), 1–7. Bloomington, MN: Pearson.

PEARSON

Copyright © 2012 NCS Pearson, Inc. All rights reserved.

Warning: No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without the express written permission of the copyright owner.

Pearson, **PSI** design, and **PsychCorp** are trademarks, in the US and/or other countries, of Pearson Education, Inc., or its affiliate(s).



NCS Pearson, Inc. 5601 Green Valley Drive Bloomington, MN 55437 800.627.7271 www.PearsonClinical.com

Produced in the United States of America.

1 2 3 4 5 6 7 8 9 10 11 12 A B C D E

Behavioral Voice Therapy in School-Age Children with Vocal Fold Nodules

Christopher R. Watts
Communication Sciences & Disorders
Texas Christian University

Structured Abstract

Clinical Question: Does behavioral voice therapy effectively improve voice quality and eliminate or reduce the size of vocal fold pathology in school-age children who have vocal nodules?

Method: Evidence-based practice intervention review

Study Sources: Cumulative Index to Nursing and Allied Health Literature (CINAHL), The Cochrane Central Register of Controlled Trials, Communication Sciences & Disorders Dome, Education Resources Information Center (ERIC), MEDLINE, PsycINFO, Scopus, EMBASE, Academic Search Complete, Conference Proceedings of the American Speech-Language-Hearing Association.

Search Terms: voice OR dysphonia OR nodules OR vocal nodules AND therapy OR treatment OR intervention AND child OR pediatric OR school age.

Number of Included Studies: 3

Number of Participants: 86

Primary Results:

- 1) Higher levels of evidence from well-controlled prospective studies of the effectiveness of voice therapy in children with vocal nodules are limited.
- 2) School-age children with vocal nodules who were treated with behavioral voice therapy experienced improved vocal abilities, as shown by acoustic and auditory-perceptual measurement results, and the vocal nodules reduced in size or were eliminated.

Conclusions:

Evidence for the effectiveness of behavioral voice therapy in school-age children with vocal nodules is not available from studies with highly controlled research designs. Prospective studies investigating this topic are very limited, though a larger number of retrospective studies are available in the literature. The best evidence from prospective studies available for this review suggests that behavioral voice therapy is effective for school-age children with vocal nodules as seen by improved voice quality and/or elimination of the nodules. However, clinicians should be cautious in generalizing this finding to all behavioral voice therapy and all children. Clinicians need to give as much weight to their own clinical experience and their clients' needs as they do to the results of a literature review when they are making decisions about behavioral voice therapy for school-age children with vocal nodules.

Clinical Scenario

Emily is a 10-year-old female going into the fifth grade. Her mother is concerned about the quality of Emily's voice, which has become chronically hoarse and low-pitched during the past 2 months of summer, between fourth and fifth grade. She took Emily to her family physician and was subsequently referred to an otolaryngologist who found that Emily had soft bilateral vocal fold nodules (i.e., there was mucosal wave movement at the site of the nodules when viewed with laryngeal videostroboscopy). The otolaryngologist educated Emily and her mom about the cause of vocal nodules, provided some brief vocal hygiene instructions, and indicated that the nodules would likely go away, if not before, then at least when Emily reached puberty. He also mentioned that they could seek an evaluation with a speech-language pathologist and talk about voice therapy if they were extraordinarily worried about Emily's voice.

At the voice evaluation with Lindsey, a speech-language pathologist in an outpatient private practice, it was found that Emily had a history of transient hoarseness, lasting 3 or 4 days, during the past few years. This coincided with Emily's involvement in an increasing number of extracurricular activities, including acting and singing with a local children's theatre, and competitive cheerleading, all of which she has continued. The most recent onset of hoarseness started after Emily began performing in a summer musical, in which she had a leading role. Emily has not received professional voice lessons for singing. She is outgoing and very talkative. Her mother describes her as a "loud" talker. Her mother indicated that her current voice problem has been causing difficulty in her singing and talking voice, and is now noticeable to everyone who speaks with Emily. Her mother asked Lindsey if speech therapy would improve Emily's voice quality and get rid of the vocal nodules. Before addressing the possibility of therapy, Lindsey told Emily's mother that she would search the literature for the best evidence for the effectiveness of voice therapy for 10-year-olds with vocal nodules and the most effective therapy approaches. Lindsey began the search to answer her primary question: *Is there sufficient evidence of behavioral therapy effectively improving voice quality and eliminating or reducing the size of vocal fold pathology in school-age children diagnosed with vocal nodules?*

Background

Dysphonia in school-age children is common, with estimates of prevalence ranging from 6% to 9% in the majority of epidemiological studies (Carding, Roulstone, & Northstone, 2006; Wilson, 1987). Among the causes of dysphonia, vocal nodules are the most frequently encountered vocal pathology found in school-aged children, with reports of diagnostic prevalence between 25% to 82% of children who seek treatment for voice problems (Block & Brodsky, 2007; Connelly, Clement, & Kubba, 2009; Mandell, Kay, Dohar, & Yellon, 2004; Van Houtte, Van Lierde, D'Haeseleer, Claeys, 2010). A recent Turkish epidemiological study surveying school-age children found a prevalence rate for vocal nodules of 16.9% in 617 non-treatment seeking school-age children between 7 and 16 years of age (Kiliç, Okur, Yildirim, & Güzelosy, 2004). Vocal nodules are typically characterized by bilateral, nearly symmetrical masses on the medial edge of the vocal folds at the point where the anterior 1/3 of the folds meets the posterior 2/3, which are almost uniformly caused by some type of vocal misuse and/or abuse. Vocal nodules also have been related to copious voice use in social situations (Roy, Holt, Redmond, & Muntz, 2007; Stemple, Glaze, & Klaben, 2000). It has been suggested that chronic dysphonia, often associated with the presence of vocal nodules, can produce negative consequences in communicative, educational, and social domains (Connor et al., 2008).

The precipitating etiology of vocal nodules is related to inappropriate vocal behaviors. The more typical and conservative approach to treating vocal nodules is voice therapy, although opinions regarding the benefit of voice therapy for vocal nodules in children before they reach puberty have not been unequivocal. One long-standing argument for withholding voice therapy from children with vocal nodules is the conviction that they will resolve after puberty without the need for voice therapy in the pre-pubescent years. Some data do support this notion. Mori (1999) reported on a case series of 20 children with vocal nodules assessed before and after puberty who received no therapy. When measured post-puberty, seven had normal vocal folds, whereas the remaining 13 children had "improved" vocal folds. However, de Bodt et al. (2007) recently reported on a case series of children who were assessed before and after puberty (some did and some did not receive voice therapy), and found only 44%

with normal vocal folds post-puberty while 29% still exhibited vocal nodules. Collectively, the weight of evidence from published studies shows that males are at a greater risk for vocal nodules pre-puberty, that vocal nodules will resolve for any number of reasons post-puberty in some but not all children, and that females are at a greater risk for maintaining or developing new vocal nodules post-puberty (de Bodt et al., 2007; Shah, Woodnorth, Glynn, & Nuss, 2005; Van Houtte et al., 2010). This increased risk for the development of vocal nodules among post-pubescent females appears to continue through adulthood.

A number of personality traits and behavioral tendencies have been attributed to children with vocal nodules in an attempt to characterize the type of child who is most at risk. Ascribed characteristics across multiple studies have included aggressive personality tendencies and immaturity, along with numerous pragmatic characteristics that point to overreaction in social communicative situations (Green, 1989; Wilson, 1987). Roy et al. (2007) administered a norm-referenced behavioral rating scale to the parents of children with vocal nodules and parents of vocally normal children (without vocal nodules). In contrast to earlier reports, these authors did not find aggressiveness and immaturity reported as significant characteristics in children with vocal nodules. However, children with vocal nodules were rated higher along a social dimension reflecting such things as peer interaction patterns and activity preferences, suggesting children with vocal nodules are more extroverted than their vocally normal peers (Roy et al., 2007). Another recent report argued against the traditional view of children with vocal nodules not being aware of or, if aware, not concerned about their vocal difficulties. Using focused interviews of parents and children with dysphonia, including those with vocal nodules, Conner et al. (2008) found that children were aware of their voice problems and concerned with the effects of these problems across physical, social/functional, and emotional domains. Reports of negative social consequences of voice problems were especially frequent in older children (Connor et al., 2008). The evidence suggests that children with vocal nodules exhibit personality traits that correspond to disproportionate levels of voice use and that they are concerned about their vocal problems due to negative social and emotional consequences.

Searching for Evidence

Lindsey began her literature to answer the question, *Is there sufficient evidence of behavioral therapy effectively improving voice quality and eliminating or reducing the size of vocal fold pathology in school-age children diagnosed with vocal nodules?*

The following resources were searched: *Cumulative Index to Nursing and Allied Health Literature (CINAHL)*, *The Cochrane Central Register of Controlled Trials*, *Communication Sciences & Disorders Dome*, *Education Resources Information Center (ERIC)*, *MEDLINE*, *PsycINFO*, *Scopus*, *EMBASE*, *Academic Search Complete*, *Conference Proceedings of the American Speech-Language-Hearing Association*. In addition, separate focused searches were conducted within association journals of the American Speech-Language-Hearing Association. Search terms for all searches included combinations of voice OR dysphonia OR nodules OR vocal nodules AND therapy OR treatment OR intervention AND child OR pediatric OR school age.

Inclusion Criteria

For inclusion in the review, clinical studies

- had to be published between 1970 and 2011;
- have an experimental design (random allocation with control group of no or alternative treatment),
- a quasi-experimental design (control group of no or alternative treatment but without random allocation to groups), or
- a prospective non-experimental cohort design (an a priori planned case series design without a control group, but prospectively took into account and attempted to control for some experimental variables);
- include children in kindergarten through twelfth grade (5 to 18 years old);
- use some behavioral voice therapy approach as one of the experimental conditions; and
- report auditory-perceptual, acoustic, and/or endoscopic measures for outcome data.

Prospective studies were selected as minimally acceptable criteria for research design because this design posed less risk to the validity of results compared to retrospective studies (Maxwell & Satake, 2006).

More than 135 articles published on vocal nodules in school-age populations were identified in the initial search. The titles and abstracts of matched searches were reviewed and compared to the inclusion checklist. Studies that appeared to potentially meet inclusion criteria were compared the inclusion criteria. Using this strategy, 26 studies were identified for further review. Of those, only **three** fully met the inclusion criteria. Of the excluded publications, **three** were epidemiological studies; **two** were non-research tutorial articles; **thirteen** presented data from retrospective chart reviews; **four** studied only adults or included children with adults, but did not separate the data of the children for analysis; and **one** study did not validate the presence of vocal nodules in children who were studied.

Evaluating the Evidence

Guidelines for Study Evaluation

Assessment of the methodological quality of the studies reviewed was based on the Levels of Evidence scale adopted by the Scottish Intercollegiate Guidelines Network (SIGN - <http://www.sign.ac.uk/pdf/sign104-ev-levels-trans.pdf>). This scale consists of six levels of evidence (1a-b, 2a-b, 3, & 4) ranked in descending order from the highest quality methodological design (level 1a) to lowest quality design (level 4). As in most published scales used to assess the quality of clinical evidence, the strongest evidence using the CEBM scale comes from systematic reviews of randomized controlled trials (RCTs). The weakest evidence on this scale comes from expert opinion.

Research Design

The three studies that met inclusion criteria used a prospective case-series design in which a single group of participants was measured before and after receiving treatment. The studies reported outcome measures on pooled group data (as a single group, pre-treatment versus post-treatment). All three methodologies were ranked as level 3 (SIGN scale), corresponding to “evidence obtained from well-designed non-experimental descriptive studies such as comparative studies, correlation studies, and case studies.” This is a lower level of evidence and any generalizations from the study results should be made very cautiously. Only one of the studies, Tezcaner et al., 2009, reported data in a form that could be further analyzed with the calculation of effect sizes.

Participant Characteristics

Data were reported for a total of 86 children from the three studies. In the Trani, Ghidini, Bergamini, & Presutti (2007) study, data from five children who had lesions other than bilateral vocal fold nodules were reported, but their data could not be separated from the reported group data. Children ranged in age from 5 to 14 years, and included a total of 49 boys and 37 girls.

Treatment Effectiveness

Behavioral treatment approaches were used for voice therapy in all three studies. The specific treatment characteristics (content, quantity, and process) varied widely among the studies, which made data comparisons between any two studies impossible. All three treatment approaches involved a clinician meeting with a child in a clinical setting as part of the treatment process. Data from Deal, McClain, & Sudderth (1981) and Trani et al. were more descriptive in nature; they did not report variability data with group means. Deal et al. presented perceptual data from laryngeal imaging (indirect laryngoscopy) taken at 2, 4, and 6 months after the initiation of voice therapy. Voice therapy consisted of children being treated for 30 minutes, two to three times per week during a 6-month period. Therapy included strategies targeting reduced talking time, reduced vocal loudness, reduced laryngeal tension, and auditory self-monitoring. By 6 months, the authors reported that nodules disappeared from 20 of the 31 children and nodule size reduced in six children (the remaining five were unable to be evaluated at 6 months). At both 4- and 6-month measurement periods, 100% of children who were available for laryngeal imaging were either clear of nodules or nodule size had reduced. There were no statistical tests applied to the data to assess how likely the reported results were due to factors other than treatment (i.e., chance).

Trani et al. treated children for 15 voice therapy sessions (reported as 10 voice therapy, 5 maintenance sessions). Voice therapy consisted of an approach reported in previous investigations referenced by the authors but was not detailed in their methodology. Outcome measures consisted of acoustic measures (jitter, shimmer, variation in fundamental frequency, noise-to-harmonic ratio, spectrograms, and phonetograms), auditory-perceptual measures (using the grade, roughness, breathiness, asthenia, and strain [GRBAS] scale), and measures of

maximum phonation time (MPT). While the authors reported an improvement “trend” post-therapy for all measures, only measures of MPT reached statistical significance, indicating that children were able to phonate significantly longer at post-therapy than at pre-therapy.

Tezcaner et al. (2009) treated children for 45 minutes a week over 8 weeks. Treatment targets included vocal hygiene, vocal abuse reduction, respiratory patterns, decreasing laryngeal hyperfunction (laryngeal massage, yawn/sigh, chewing), and stretching exercises. The accent method and resonant voice therapy were also employed. The degree to which these targets and methods were addressed with each child varied and was dependent on the child’s cooperation. The authors reported data from acoustic measures (fundamental frequency, jitter, shimmer, and noise-to-harmonic ratio) and auditory-perceptual measures (using the GRBAS scale). Statistically significant results reported for jitter, shimmer, noise-to-harmonic ratio (NHR), and all auditory-perceptual categories, with exception to “asthenicity” (vocal power—the “A” in the GRBAS scale), indicated improvement at post-treatment. Effect sizes on the findings were reported as: jitter ($d = 0.52$, medium effect), shimmer ($d = 0.48$, medium effect), NHR ($d = 0.32$, small effect), grade ($d = 1.99$, large effect), roughness ($d = 1.05$, large effect), breathiness ($d = 1.76$, large effect), and strain ($d = 0.70$, medium-to-large effect). The medium (for acoustic) to large (for auditory-perceptual) effect sizes, suggest practical and statistical significance.

Data Analysis and Interpretation

Two included studies (Deal et al., 1981; Trani et al., 2007) presented mostly descriptive data without variability measures, which prevented further data analysis of the reported results. In the third study (Tezcaner, Ozgursoy, Sati, & Dursun, 2009), effect sizes were calculated for acoustic and auditory-perceptual outcome measures. Effect sizes typically reflect the magnitude of an effect, such as the effect of a treatment, with standardized pre-treatment and post-treatment scores. Cohen’s d was used to measure effect size and was calculated by dividing the pre-treatment and post-treatment mean scores by their respective standard deviations. Effect sizes of .20, .50, and .80 are typically interpreted as small, medium, and large effects, respectively (Cohen, 1988).

The included studies were reviewed for treatment integrity (TI), also called treatment fidelity. This is the

degree to which an independent variable (e.g., a treatment type, such as voice therapy) is applied as originally intended in the study methodology. Assessment of TI is important in clinical research because the validity of treatment outcomes is dependent on treatment characteristics, such as the content, quality, quantity, and process of the treatment. These characteristics are variables that can and should be measured within a study (Sanetti & Kratochwill, 2009). Recognition of the importance of TI is growing; however, assessment and reports of TI are not often reported. None of the included studies measured or reported TI.

Interrater Reliability

The included studies also were reviewed for inter-rater reliability (IR). The degree to which ratings or measurements (such as auditory-perceptual measure of voice quality or acoustic measures of voice function) made independently by two or more individuals agree with each other is an indicator of measurement reliability. None of the three studies reviewed in this brief measured or reported inter-rater reliability.

Conclusions

The review of the literature published between 1970 and 2011 yielded only three studies with prospective research designs and clinical outcome data sufficient for critique. Only one of these studies reported data that could be further evaluated by calculating effect sizes. Although the inclusion criteria was restricted to Level III for studies in this review, the evidence supports a tentative conclusion that behavioral voice therapy effectively improves voice quality and reduces the size or eliminates vocal nodules in school-age children. However, these studies also support the conclusions drawn from other studies (Roy et al., 2007) that efficacy for treatment of vocal nodules in children has not been adequately investigated through well-designed studies.

There are major limiting factors to this conclusion that clinicians should consider when making clinical decisions based on the evidence. Across the three studies, the lack of higher quality research designs, methodology, and data are not comparable to each other. Though two studies targeted vocal hygiene and intervention techniques aimed at reducing laryngeal hyperfunction during voice production (i.e., “reducing laryngeal tension” and

“resonant voice therapy”), the specific therapy methods were not adequately described and could not be compared. The method used to obtain outcome variables across the three studies was inconsistent. Though acoustic and auditory-perceptual measures were obtained in two of the three studies, the specific methods used to obtain these and the specific measures obtained were different. It is difficult to directly compare the three studies because of their different inclusion criteria, including the age ranges studied and the distribution of males and females in the study groups.

When making clinical decisions about voice therapy for school-age children with vocal nodules, clinicians should consider reports from epidemiological and qualitative studies that have reported gender differences in nodule development, maintenance post-puberty, and the social/emotional effects of these lesions. When considering the specific question of whether or not to implement voice therapy before puberty, studies have shown that vocal nodules do have negative social and emotional affects on school-age children (Connor et al., 2008). Evidence also has also shown that vocal nodules may remain in males and females after puberty, though the risk for nodule maintenance is much greater in females, even with voice therapy (deBodt et al., 2007; Mori, 1999; Van Houtte et al., 2009).

Though the evidence from this review supports the use of behavioral voice therapy in school-age children with vocal nodules, this should not be considered a conclusive finding. It should be considered suggestive, based on the best available evidence, until further findings are reported from more well-controlled prospective studies. Outcome data from prospective studies have demonstrated improvements in auditory-perceptual ratings of voice quality, acoustic measures of vocal function, and visual ratings of nodule size after voice therapy in children with vocal nodules. Though males are at greater risk for nodule development before puberty and females are at greater risk for maintaining nodules or developing new nodules after puberty, vocal nodules can have significant negative social and emotional consequences for both, and should be considered when determining treatment for this population.

Integrating the Evidence to Make a Treatment Decision

Lindsey followed up with Emily and her mother and suggested, based on her literature review and clinical experience, behavioral voice therapy. After some discussion, Emily’s mother decided to enroll her in voice therapy. The factors that were important for them in making the decision included the significant negative impact the voice problem was having on Emily’s social and recreational activities and the greater risk of nodule maintenance after puberty due to Emily’s gender. Lindsey put together an eclectic plan of voice therapy based on approaches to treatment reported in the Tezcaner et al. (2009) and Deal et al. (1981) articles, which also translated well to Lindsey’s clinical experience treating clients with voice disorders.

Therapy targets included education and implementation of a vocal hygiene program (including reduction of total talking time during the day, decreasing loudness of speech, periods of vocal rest after heavy vocal loads such as singing practice, and adequate hydration), acquisition and maintenance of diaphragmatic breathing patterns to better support phonation, and utilization of resonant-based phonation to decrease the degree of laryngeal hyperfunction when speaking. In addition, Lindsey asked Emily to keep a daily log of voice use patterns, including the amount of time she spoke or sung during different periods of the day, and whether volume of talking at these times was soft, normal, or loud. Emily was scheduled for voice therapy twice a week after school for the first 3 weeks to establish initial acquisition of therapy targets, followed by once a week for the remainder of therapy. Baseline data from the initial voice evaluation, including auditory-perceptual data and acoustic data, were to be used for clinical comparison of similar measures to be taken throughout therapy to assess progress. It was also recommended that Emily receive professional voice training for her singing voice to ensure proper technique was being utilized.

References

- Block, B., & Brodsky, L. (2007). Hoarseness in children: The role of laryngopharyngeal reflux. *International Journal of Pediatric Otorhinolaryngology*, *71*(9), 1361–1369.
- Carding, P. N., Roulstone, S., & Northstone, K. (2006). The prevalence of childhood dysphonia: A cross-sectional study. *Journal of Voice*, *20*(4), 623–630.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). Hillsdale, NJ: Lawrence Erlbaum.
- Connelly, A., Clement, W. A., & Kubba, H. (2009). Management of dysphonia in children. *Journal of Laryngology & Otolaryngology*, *123*(6), 642–647.
- Connor, N. P., Cohen, S. B., Theis, S. M., Thibeault, S. L., Heatley, D. G., & Bless, D. M. (2008). Attitudes of children with dysphonia. *Journal of Voice*, *22*(2), 197–209.
- Deal, R. E., McClain, B., & Sudderth, J. F. (1981). Identification, evaluation, therapy, and follow-up for children with vocal nodules in a public school setting. *Journal of Speech & Hearing Disorders*, *41*, 390–397.
- de Bodt, M., Ketelagiers, K., Peeters, T., Wuyts, F., Mertens, F., Pattyn, J., Heylen, L., Peeters, A., Boudewyns, A., & Van de Heyning, P. (2007). Evolution of vocal nodules from childhood to adolescence. *Journal of Voice*, *21*, 151–156.
- Green, G. (1989). Psychobehavioral characteristics of children with vocal nodules. *Journal of Speech & Hearing Research*, *54*, 306–312.
- Kiliç, M. A., Okur, E., Yildirim, I., & Güzelsoy, M. (2004). The prevalence of vocal nodules in school-age children. *International Journal of Pediatric Otorhinolaryngology*, *68*, 409–412.
- Maxwell, D., & Satake E. (2006). *Research and statistical methods in communication sciences and disorders*. Boston: Thomson Delmar.
- Mandell, D., Kay, D., Dohar, J., & Yellon, R. (2004). Lack of association between esophageal biopsy, bronchoalveolar lavage, and endoscopy findings in hoarse children. *Archives of Otolaryngology Head and Neck Surgery*, *130*, 293–297.
- Mori, K. (1999). Vocal fold nodules in children: Preferable therapy. *International Journal of Pediatric Otorhinolaryngology*, *49*(Suppl. 1), S303–S306.
- Roy, N., Holt, K. I., Redmond, S., & Muntz, H. (2007). Behavioral characteristics of children with vocal fold nodules. *Journal of Voice*, *21*(2), 157–168.
- Sanetti, L., & Kratochwill, T. (2009). Toward developing a science of treatment integrity: Introduction to the special series. *School Psychology Review*, *38*(4), 445–459.
- Shah, R. K., Woodnorth, G. H., Glynn, A., & Nuss, R. C. (2005). Pediatric vocal nodules: Correlation with perceptual voice analysis. *International Journal of Pediatric Otorhinolaryngology*, *69*, 903–909.
- Stemple, J. C., Glaze, L. E., & Klaben, B. G. (2000). *Clinical voice pathology: Theory and management* (3rd ed). San Diego: Singular/Thompson Learning.
- Tezcaner, C. Z., Ozgursoy, S. K., Sati, I., & Dursun, G. (2009). Changes after voice therapy in objective and subjective voice measurements of pediatric patients with vocal nodules. *European Archives of Otorhinolaryngology*, *266*, 1923–1927.
- Trani, M., Ghidini, A., Bergamini, G., & Presutti, L. (2007). Voice therapy in pediatric functional dysphonia: A prospective study. *International Journal of Pediatric Otorhinolaryngology*, *71*, 379–384.
- Van Houtte, E., Van Lierde, K., D’Haeseleer, E., & Claeys, S. (2010). The prevalence of laryngeal pathology in a treatment-seeking population with dysphonia. *Laryngoscope*, *120*(2), 306–312.
- Wilson, D. K. (1987). *Voice problems in children* (3rd ed.). Baltimore: Williams & Wilkins.