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The Voice

The Voice

VOICE OF THE EDITOR

Mary Sandage, PhD

Assessing, Treating and Training VOICES OF CHILDREN

IN THIS ISSUE:

BY MARY SANDAGE, PHD

It seems that most of our attention in the world of voice habilitation and rehabilitation focuses on the fully developed mature voices of our adult clients and voice students. For many of us in practice, we also encounter young children and adolescents with voice impairment, both congenital and acquired.

Assessing, treating and training the voices of children and adolescents requires special consideration. In this pediatric-focused issue I have invited researchers and practitioners who specialize in pediatric voice to share their expertise. Rita Patel, PhD, provides an update on recent high speed laryngeal imaging findings in pre-adolescent children. As it turns out the old adage that children are not little adults appears to be true for vocal fold vibratory characteristics.

Maia Braden and Leslie Kessler both provide important clinical perspectives on child learning. Ms. Kessler considers learning differences in young children and delineates important adaptations to make in resonant voice treatment approaches. Ms. Braden skillfully describes the moving target that is the adolescent performing voice.

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Voice of the Editor

WORKING WITH INJURED PEDIATRIC PERFORMERS

By Maia Braden, MS, CCC-SLP

Like adult performers, preteen and teenage singers are vocal athletes and face similar risks for injury. However, young performers also present a separate set of challenges from their adult counterparts. They do not have fully mature instruments to begin with, are developing mature vocal technique, and learn differently from adults. Their vocal demands are different, and they have different barriers and supports to therapy than adults.

LARYNGEAL DEVELOPMENT AND VOICE MATURATION

The adolescent voice is a moving target for a variety of reasons. The mature 5-layer structure of vocal folds is not fully differentiated until the teen years, between 14 and 17 years of age, and the length of the membranous vocal fold in relation to the cartilaginous portion increases with age.[1] Male pubertal changes are marked by rapid growth in vocal fold length and in vocal tract length, and females undergo voice change as well, with a lowering and then expansion of range.[2-4] If we consider how singing involves finely coordinated adjustments of vocal fold length and tension, vocal tract dimensions, respiratory control, and use of articulators, rapid changes in any of these, as well as developing fine motor control are likely to lead to instability. It is normal in adolescence to experience change in voice type, periods of instability, and periods of increased difficulty with register transitions, due to these changes occurring.[5] Sometimes attempts to navigate these changes can result in maladaptive compensations predisposing singers to vocal injuries.

TRAINING AND TECHNIQUE

When we see adult injured singers, most have established singing technique. Conversely, most very young singers are still in the infancy of developing their technical skills. They may have a vague idea of optimal breathing for singing, alignment, resonance, and coordination of the subsystems of respiration, phonation and resonance. More often, they are going entirely on instinct. Developing singers often try to imitate much older performers, and may receive a great deal of positive reinforcement for doing this – it seems as if listeners are always inordinately impressed when they hear a 10-year-old who sounds like a 30-year-old. Young singers (in fact all singers) should be encouraged to sound like the best version of themselves, and both singing teachers and speech pathologists who

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WORKING WITH INJURED PEDIATRIC PERFORMERS, CONTINUED

(Continued from page 2)

work with singers should address the basics of healthy vocal technique.

LEARNING

Pre-teens and teens are in a period of very rapid learning, and they are accustomed to learning new things every day. In this way, they can be easier to work with than adults. However, we need to keep in mind some of the learning differences in this age group. Their pre-frontal cortex is still developing, and while executive function is improving, they often struggle with impulse control and prioritization.[6] Adolescents learn best when the learning is meaningful and authentic, and when they have opportunities to set their own goals and monitor their own progress. This means asking them what they hope to accomplish, and asking them to judge their own performance and adherence to therapy tasks. Learning needs to be presented in multiple ways (written, modeled, experienced, recorded) to support their best learning.

VOCAL DEMANDS

Teens often have extremely full schedules both at school and after. They may be playing a sport, performing in a play, working a part-time job, and singing in a band, at church, or in a choir. Combined with the lower impulse control that comes with adolescence and the natural desire to be social and talk, vocal demands of adolescents can be extremely high. Therapy should focus on healthy production in *all* voice use. After all, we don't put our "singing" voice away and take out our "speaking" voice. In fact, teenagers may be using a healthier production technique when singing than when speaking. Given all of their competing vocal demands, we discuss voice prioritization rather than limitation, and help them to see their voice as a long-term project. When being told what to do and what not to do, they are likely to respond defensively, but when approached as collaborative problem-solving, they are more likely to make healthy choices on their own.

> "The adolescent voice is a moving target for a variety of reasons."

EXTERNAL SUPPORTS

While parents may be a primary support in therapy, peers and other adults also play a supporting role. Other adult supports include choir directors, teachers, voice teachers and coaches, and theater directors. Collaboration with everyone involved in a patient's voice care is necessary to make sure that the patient is getting all they need. Conversations about healthy vocal technique, vocal expectations, and making sure that the same recommendations are being reinforced in all settings are vital.

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CONCLUSION

In working with pre-teen and teenage performers, we have the unique opportunity to set them up for success in the future. We still have much to learn about how the voice develops, and as we do we can serve this population better. With these factors in mind, we should not shy away from working with this popu-

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WORKING WITH INJURED PEDIATRIC PERFORMERS, CONTINUED

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lation, but should use our knowledge of vocal rehabilitation to help them recover and develop into successful adult performers.

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WHAT DO WE KNOW OF VOCAL FOLD VIBRATORY MOTION

IN CHILDREN?

By Rita R. Patel, PhD, CCC-SLP

Voice disorders occur across the lifespan, are disabling and compromise quality of life. Conservative estimates of children suffering from voice disorders suggest that over 1 million or 6-9% children experience voice problems nationwide.[1] Other estimates have placed the occurrence of voice disorders in school-aged children as high as 16%.[2] Because a voice disorder results in an alteration of voice quality (i.e. dysphonia or hoarseness), an untreated voice disorder can substantially hinder children's academic performance and overall psychological well-being.[3-5] Hence early identification and treatment of voice disorders in children is essential. The clinical evaluation and treatment of voice disorders in children requires a clinician to assess the vocal fold structure and function. Children not only have smaller laryngeal structures but also differ substantially in terms of the vocal fold layered structures.[6-9] The five layers of the vocal folds are not fully developed in children, but mature only after puberty. Since structurally, the children's vocal folds are not simply a smaller-sized version of the adult vocal folds, information on vibratory motion from adults cannot be directly used for interpretation of children's vocal fold vibratory motion.

A comprehensive evaluation of vocal fold function involves the evaluation of the pliability and the cycle-to-cycle motion of the vocal folds over a period of time. As the vocal fold vibrations are too rapid for the human eye to detect, it is critical to slow the motion of the vocal folds in order to evaluate their function. In children, the vocal folds vibrate anywhere between 218 to 329 times per second.[10] Such rapid vibrations are difficult for the human eye to perceive with simple endoscopy, which uses a straight halogen light. The current state-of-the-art clinical assessment technique is stroboscopy: a flashing light and an endoscope are used to observe *apparent* cycles of vocal fold vibrations.[10] The vocal fold vibratory cycle consists of three phases: the opening phase, the closing phase, and the closed phase (Figure 1). Stroboscopy allows us to view the vocal fold motion at a slower rate by illuminating only parts of successive cycles—but at the price of substantial information loss. That is, stroboscopy does not provide the viewer with information from each cycle of vocal fold vibration, but instead illuminates only parts of successive cycles. Moreover, it does not work well for severely impaired voice qualities[11] or short phonations of 2-3 seconds,[12] both of which are frequently encountered in clinical examinations in children. A rela-

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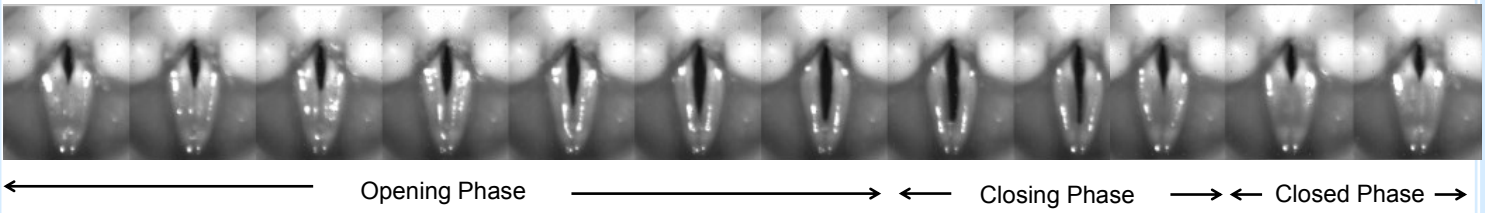
The Voice of the Therapist

Figure 1: One glottal cycle in a 10 year old female child



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tively new method of laryngeal high-speed videoendoscopy can image the vocal folds at 8000 frames per second: an enormous advance on stroboscopy, which images the vocal folds at 30 frames per second.[13] Because of this increased temporal resolution, high-speed videoendoscopy allows for effective evaluation of the entire range of voice qualities and durations encountered in the pediatric population.

Our findings from both qualitative and quantitative evaluation of cycles of vocal fold vibrations have revealed that vibratory motion in children is not a small version of adult oscillation, but is functionally different. Our studies have focused on evaluation of steady-state sustained phonation at typical pitch and loudness in pre-pubertal children between the ages of 5 and 11 years. We used high-speed videoendoscopy to image the vocal folds, allowing us to view individual cycles of vocal fold vibrations and then slow them down for further viewing and analysis. We found that children's vocal fold vibrations differ from those of adults in several ways.

First, children have a higher prevalence of a posterior phonatory gap (girls = 85%, boys = 68%) compared to adults (females = 75%, males = 54%).[14] The posterior gap when present in children also appears to be more like a 'diamond' shape, i.e. extending not only in the posterior direction, but also in the anterior direction from the vocal process. This means that the presence of a posterior gap is not an indication of an abnormality, but part of the normal development of vibratory motion in children.

Second, children's vocal fold vibratory motion is characterized by a longer opening phase and a relatively shorter duration of the closing phase compared to vocally healthy young adult male and females.[15,16] Typically developing children also showed a significantly larger amplitude-to-length ratio compared to adult females.[15] These findings suggest that vocal fold movements of typically developing children are more similar to those of adult males than adult females. Further, the excessively large amplitude-to-length ratio and the relatively shorter closing phase interval may explain why children have a harder time varying pitch and loudness independently of each other.

Interestingly, children also have a longer longitudinal phase delay between the anterior and the posterior parts of the vocal fold during the opening phase. The closing phase in children is more shutter-like without the longitudinal phase delay; more than adults.[16] These differences suggest that children might have a different mechanism for opening and closing the vocal folds than adults do.

Third, children's vocal fold vibrations are more inconsistent from one cycle to another, i.e. children exhibit greater cycle-to-cycle variability. More specifically, children exhibited greater variability in both amplitude and time periodicity compared to adult men; however, they

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were similar in terms of these parameters to adult females.[17] Furthermore, the use of the Phonovibrogram image-based analysis technique to investigate movement of the anterior and posterior glottis during the opening and closing phases of the glottal cycle revealed greater differences in cycle-to-cycle variability along the anterior glottis during the closing phase. This increased variability suggests that the closing phase is more variable compared to the opening phase.[16] The presences of these aperiodicities in vibratory motion would need to be taken into account when interpreting vocal fold vibratory motion during a clinical evaluation.

In conclusion, these findings indicate that vocal fold motion in children is complex and not easily predicted from adult normative data. We need to develop child-specific norms, because adult-like vibratory motion is not completely established by 11 years of age but continues to develop during this period.

Dr. Rita Patel is an assistant professor at the Department of Speech and Hearing Sciences, Indiana University. Her research and clinical expertise focuses on addressing the vibratory kinematics of normal and abnormal voice in the adult and pediatric population, with high-speed videoendoscopy. Prior to starting her position at Indiana University, she was an Assistant Professor and Director Voice Clinic at the University of Kentucky for four years. Since her doctoral degree in 2006 Dr. Patel has been awarded 7 extramural grants from National agencies including ASHA and NIH; and 4 intramural grants. Dr. Patel has received 15 awards and 2 fellowships for her work in the area of voice. Currently she is the Associate Editor for the journal *Language, Speech, and Hearing Services in Schools*. She is also the coordinator of ASHAs Special Interest Group 3, Voice and Voice Disorders.

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PEDIATRIC VOICE THERAPY: HOW CHILDREN LEARN BEST

By Leslie S. Kessler, MA, CCC-SLP

When I started providing pediatric voice therapy I knew it was necessary to develop a true resonant voice therapy program which mimicked the fine resonant voice therapy we provide our adult voice patients.

As a well-trained clinician I immediately began to facilitate awareness of vibrations in the front of their little faces. I did not use the word "vibrations" because I thought children would not understand this big word. I began using the word "buzzy" like a bee.

I felt so smart and inventive because my little ones so quickly reported feeling the "buzzy" on their lips, nose in their mouths and even their cheeks. Fortunately, I became skeptical of this immediate learning because adults, who have knowledge and experience with vibrations, did not catch on this quickly.
One day I started asking "do you feel the buzzy on your elbow?" "oh yes" "and on your knee? ", "yes my knee is very buzzy!"
Lesson learned…most children have never had enough experience or any experience with cognitive awareness of vibrations and so cannot be expected to determine presence or lack of presence of vibrations.

Proprioception of vibratory sensations is the foundation of resonant voice therapy. We needed a pediatric voice therapy which first addressed the child's lack of specific prior sensory, cognitive and language-based knowledge and experience, already present in the adult.
But, to facilitate this specific knowledge in children it is important to acknowledge that children learn differently from adults, and techniques that are detrimental to motor learning in adults (imagery and metaphors, for example) are key to child learning.

There is research specifically targeting child skill acquisition and cognitive/motor learning which highlights some differences in child and adult learning.

USE OF METAPHORS - ADULT POPULATION

Katherine Verdolini-Abbot PhD, CCC-SLP et al has published robust findings reporting that use of metaphors in teaching adults inhibits motor learning.

CHILD POPULATION

Laura S. DeThorne et al, (2009) reveals the results of their study indicated 1) greater accuracy and less variability with external focus for tongue and hand control tasks, consistent with previous limb studies in adults and 2) pairing of specific speech sounds with meaningful environmental sounds, objects or events may lessen the load on the child's working memory during complex motor tasks. This metaphoric language engages visual processing skills or episodic memory and unburdens reliance on phonological processing. Examples of these metaphors are /u/ for monkey, /m/ for the yummy sound. I chose "buzzy bee" and "croaky frog" for Buzzy Child.

Sawada, MOM, & Ishii (2002) reported that 4 - 5:11 year old children were unable to attend to particular and relevant features of modeled actions, to learn a sequence of five dance steps and performed better with a verbal model. The verbal model chosen were specific metaphors. The rationale, according to Weiss, Ebbeck, & Wiese-Bjornstal (1993) "it is critical for young children to understand a physical task by associating it with a label and then relate the label to their own experiences." Therefore, metaphoric language is recommended when teaching motor skills. Results of this study indicated that metaphorical verbal instruction was more effective than demonstration to support

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The Voice of the Clinician

ACOUSTIC PEDAGOGY, CONTINUED

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young children's motor learning of sequential dance steps skills (4-5:11). Older children (7-8:11) benefited from both forms of instruction. According to these findings specific metaphorical instruction is appropriate to use with 4 - 8:11 year old children as an effective teaching and "learning strategy."

Research results pertaining to children, strongly suggest that the use of metaphorical instruction benefits young children where adults do not benefit from metaphorical instruction and perform more poorly. There seems to be no clear-cut age benchmark identifying "young children" but research suggests children three – seven chronological/developmental years are the children who

reap the most benefit from metaphorical instruction, although some studies report these same benefits through 9 or 10 years. Based on these and other cognitive-developmental factors in motor learning and modeling, specific metaphorical verbal instruction as described above or verbal rehearsal apparently influences modeling of a movement sequence in young children, as it enables young children to attend to task-relevant information (Sawada et al, 2002) thus affording them effective strategies for motor learning. Somewhere between 12-17 years old there appears to be a shift from the child model of learning, to adult the model of learning.

SKILL ACQUISITION IN CHILDREN - HOW LONG DOES IT TAKE?

Jacoby et al. (2002) conducted a study to determine the average number of treatment units (15 minutes per unit) needed to achieve improvements in communication (voice being part of communication). The subjects in this study were 234 children between the ages 3-6 years old. The authors used a 7 level functional rating scale derived from the NOMS. (Level 7 was the discharge level.) The overall findings were that children required, on average, 20 hours of therapy to progress 1 level (7 levels in all.) Children were seen two times per week. The number of sessions per week is also important. If a child is seen two times per week vs one time, it allows the clinician to move a child forward if a skill is achieved or if the child is struggling it allows the clinician to make adjustments sooner.

It is essential for pediatric voice clinicians to know the cognitive underpinnings of how children learn in order to successfully choose appropriate vocabulary and tasks which will facilitate successful healthy voice skill acquisition.

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Leslie has developed proprietary, research-based therapy programs in a variety of domains within speech-language pathology. Included in these interventions is Buzzy Child-Resonant Voice Therapy That's Fun! Buzzy Child has been researched road -tested refined in our clinical practice at Language & Voice Experience, over the past 13 years.

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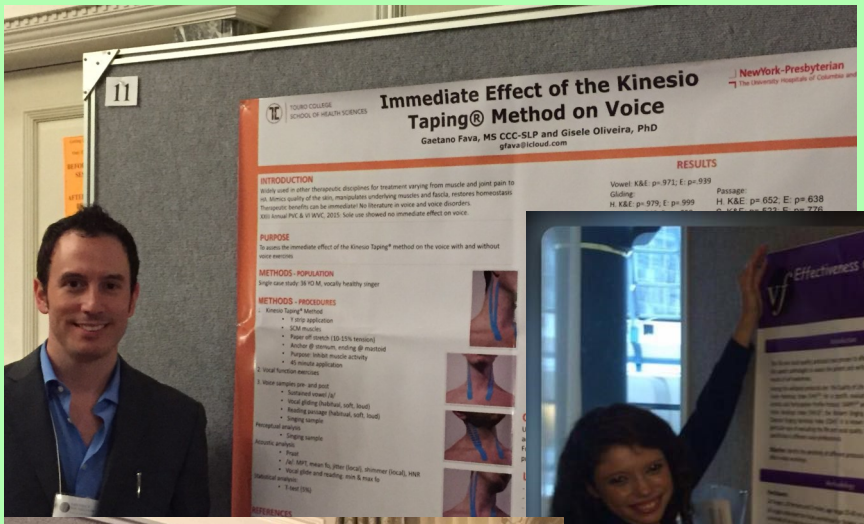

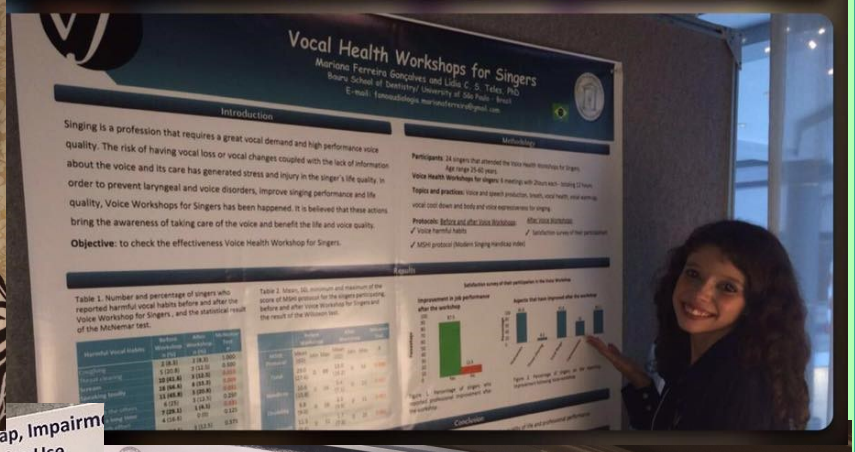

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Walt Hunter is a Philadelphia native and an investigative reporter with KYW-TV. He joined the station in 1980 as a crime reporter and was named best television reporter by Philadelphia Magazine in 2004. He has received eight Philadelphia Emmy Awards. The Broadcast Pioneers of Philadelphia inducted Hunter into their Hall of Fame in 2007.