

Ingo Titze, Associate Editor

Unsolved Mysteries about Vocal Fatigue and Recovery

Ingo R. Titze



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NEARLY EVERYONE WHO SPEAKS or sings a lot has encountered vocal fatigue. There are exceptions. Some people's voices seem never to tire, regardless of how long or how loud they phonate. Informal observation suggests that these people are not necessarily vocally trained, which raises doubt about a belief that vocal fatigue is primarily related to faulty technique. Faulty technique likely will accelerate the onset of fatigue, but may not be the primary cause.

We define vocal fatigue as the diminished vocal ability (or perception of such by the vocal performer) when effort remains constant. Conversely, it is the increase in effort required to maintain the same vocal ability. Although this definition is easy to grasp conceptually, the difficulty lies in quantification. How do we measure vocal ability and how do we measure vocal effort? In the studio, both are routinely assessed by student–teacher interaction. “That sounded better—how did it feel?” is the question, and “It felt easier” might be the answer. In this setting, the teacher assesses the vocal ability and the student assesses the effort. Repetition of an exercise, a phrase, or a song with improved technique at first will improve the vocal ability and also reduce vocal effort—a double whammy! Further continued practice may improve ability, but effort may not decrease. The process is now hanging in a balance. With further belabored practice, ability may actually decrease and effort may increase—another double whammy, but in the opposite direction!

As both teacher and student sense the point of diminishing returns, practice is called off. In a half-hour or one hour lesson, this point may never be reached. But in a more professional setting where practice continues over the entire day, or in an amateur setting when getting ready for a show is on everyone's mind, calling off a practice may require wisdom, good judgment, and perhaps economic risk.

The most confounding problem in dealing with vocal fatigue is not knowing how much voice rest is needed for recovery. If we call it off, when do we resume? Is a ten minute refreshment break useful? How about an hour lunch break? Can we start in tomorrow morning and assume that we are all fresh? Our assumptions about “return to normal” are based primarily on experience with physical exercise involving our arms, legs, and torso. Recovery from exercise fatigue is mostly muscle recovery, although joints and tendons can be overworked as well. The time course for recovery from muscle fatigue is usu-

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ally quite fast, on the order of minutes to hours, unless we have developed an obvious muscle ache. Recovery from joint and tendon fatigue may take longer, on the order of days. But for the most part we work through it, allowing the tissue to heal while exercise continues.

Vocal fatigue and recovery contain all of the elements of arm, leg, and torso fatigue, but in addition there is an exposure problem to tissue vibration. During vocal fold vibration, fluids and protein structures are tossed back and forth repeatedly, capillaries are widened and narrowed, and all of the transport of nutrients and cellular waste products through the tissues is affected. It is a bit like transporting materials with trucks over highways during an earthquake or a hurricane. Some transportation may be slowed down and some may come to a complete stop. Carrying this analogy a bit further, if the winds and the unstable roads subside a bit, how quickly can the trucks get going again?

We believe that some of the “quake” and “storm” in vocal fold vibration may cause a redistribution of fluids. There may even be a dislodging of water molecules from macro-molecules that create gel-like substances in the vocal folds. Vibration may bring about a breaking of chemical bonds by agitation. Newly created free water molecules may move easily and quickly through the tissue and disperse or accumulate in other places. In the water-depleted region, less lubrication may exist for tissues that have to slip and slide over each other. A measureable consequence may be a higher phonation threshold pressure, which has been recognized as a measure of “ease” of phonation. What is currently a mystery is the speed at which a redistribution of fluids or a disruption of nutrient and waste product transportation can be reset to normal. It could be as little as a few minutes or as much as several hours. In addition, repair of damaged protein tissue structure can take several days.

So, are we ready to sing or speak again, with everything back to normal, the morning after a tough rehearsal? We simply don't know. Considerable research is ongoing in this area. I will continue to update the readership as advances in research are made. For the moment, try using soft phonation at high pitches as your barometer. If soft and high voice is difficult, especially the day after a strenuous workout, you probably have not fully recovered. The fluid and structural protein disar-

ray and repair I have talked about occur mainly in the soft tissue directly under the skin of the vocal fold. It is the integrity of this tissue that is critical for soft voice at high pitches.

Ingo R. Titze is Distinguished Professor of Speech Science and Voice at the University of Iowa and Executive Director of the National Center for Voice and Speech at the Denver Center for the Performing Arts. His formal education is in physics and electrical engineering, but he has devoted much of his studies to vocal music and speech. Dr. Titze has published more than 500 articles in scientific and educational journals, coedited two books titled *Vocal Fold Physiology*, and has authored two books called *Principles of Voice Production*, and *The Myoelastic Aerodynamic Theory of Phonation*. He has lectured throughout the world and has appeared on such educational television series as *Innovation*, *Quantum*, and *Beyond 2000*. He is a recipient of the William and Harriott Gould Award for laryngeal physiology, the Jacob Javits Neuroscience Investigation Award, the Claude Pepper Award, the Quintana Award, and the American Laryngological Association Award. He is a Fellow of the Acoustical Society of America and the American Speech-Language-Hearing Association. Dr. Titze has served on a number of national advisory boards and scientific review groups, including the Scientific Advisory Board of the Voice Foundation and the Division of Research Grants of the National Institutes of Health. In addition to his scientific endeavors, Dr. Titze continues to be active as a singer. He is married to Kathy Titze and has four children. Mail should be addressed to Ingo R. Titze, National Center for Voice and Speech, 330 WJSHC, Iowa City, IA 52242. Telephone (319) 335-6600.

I heard you solemn-sweet pipes of the organ as last
Sunday morn

I pass'd the church,

Winds of autumn, as I walk'd the woods at dusk

I heard your long-stretch'd sighs up above so
mournful,

I heard the perfect Italian tenor singing at the
opera,

I heard the soprano in the midst of the quartet
singing;

Heart of my love! You too I heard murmuring low
through one of the wrists around my head,
Heard the pulse of you when all was still ringing
little bells

last night under my ear.

Walt Whitman (1819–1892)

from *Children of Adam*