Perspectives on Adult Cochlear Implant Rehabilitation by a Graduate of Pediatric Auditory Rehabilitation

In Memory of Mary Wood Whitehurst

At the age of 98, Mary Wood Whitehurst died in Delaware on July 23, 1999. Who was this remarkable lady? You might think she was the oldest recipient of a cochlear implant. No, she did not receive a cochlear implant, but she was a hearing impaired lady who left a trail-blazing legacy dating back to the 1940s for those of us with hearing loss. Ms. Whitehurst authored 19 books on auditory training, headed the Hearing and Speech Clinic at Manhattan Eye, Ear and Throat Hospital, worked at the Children's Hospital in Washington, DC, and supervised auditory training at army rehabilitation centers during World War II.

After World War II, infants and children with severe hearing losses were routinely taught sign language without the expectation that they would participate in the hearing world. Mary Wood Whitehurst radically advocated fitting children four years or younger with hearing aids along with intensive auditory rehabilitation to utilize their residual hearing. As far back as I (Paul) can remember, when I was about four years old or younger, I had one-on-one hourly sessions three times a week with this remarkably serene lady. We sat in child-sized chairs at low round tables. From my childhood perspective, Ms. Whitehurst was so tall and I could never understand how she could sit in these small chairs to work with me. She had black hair, which covered her ears — and the temples of her eyeglass hearing aids. Actually I did not know that she wore hearing aids until I was 11 or 12 years old.

She possessed a forthright gentleness and spoke with quiet authority. Her reassuring smile radiated confidence. I never felt that we had this overwhelming task ahead: learn to speak, hear and read. I remember feeling that she knew what I was about and was comfortable with me without the anxiety that I later perceived in other adults. Even though she worked with me in a no-nonsense formal manner, she exuded such confidence and warmth that I felt comfortable with myself and trusted her encouragement.

She spoke beautifully, and as a result, I was surprised to learn that she had a hearing loss and wore eyeglass hearing aids. Only later, during my residency at the Massachusetts Eye and Ear Infirmary, Harvard Medical School, did I find out that she had otosclerosis (conductive hearing loss), which became symptomatic during her college years. As a child I never identified her as someone with a hearing loss, but I appreciated that she seemingly knew more about what a hearing loss meant than anyone else I had met. She also led me to assume that there was no reason to anticipate any limitations associated with my hearing loss.

Ms. Whitehurst seamlessly utilized reading to teach me to speak by matching up "the sounds" to visual letters of the alphabet. The visual letters were an adjunct with which to reference sounds in my mind. To this day, the written word frequently comes to mind when I "hear." We also had hours of auditory therapy: listening to words

Paul E. Hammerschlag, M.D., F.A.C.S., and Jane R. Madell, Ph.D.

and stories without visual clues (lipreading), to develop whatever auditory function I had. Her concept of intensive auditory rehabilitation for severe congenital hearing loss is not unlike the post cochlear implantation therapy utilized today for children, who are taught to develop and use their emerging auditory pathways.

Two instances later in life confirmed for me that new auditory pathways and the ability to listen without visual input could be established with varying degrees of success in hearing impaired adults. When I was younger, I observed that my auditory abilities were particularly heightened after I was fitted with a new hearing aid. This auditory enhancement was consistent for me — and transient — for a period of a few weeks. I called this period of markedly improved hearing associated with new hearing aids a "honeymoon." For example, only during this honeymoon period, could I consistently understand rear seat passengers behind me in a car despite background wind and engine noise. Nevertheless, my improved auditory function was still based upon auditory capabilities, the development of which was initiated by Mary Wood Whitehurst. As my hearing deteriorated, these transient honeymoon periods of improved hearing with new hearing aids were less frequent.

The second instance where I realized that I could develop new auditory pathways and develop my ability to hear without lipreading occurred in Europe. After high school, my parents sent me to Spain to learn a foreign language. It was too difficult for me to learn a foreign language in a typical high school classroom setting with background noise and participating conversationalists scattered around the room. (Fortunately, I was allowed to fulfill my language requirement in high school with a "dead" unspoken language: Latin.) In Spain I participated in a daily two-to-three hour class with one

other student (who had normal hearing). The class was intensely conversational but only in Spanish. Although I knew that I was learning to lipread in Spanish, my instructor's rapid-fire conversation demanded immediate response from me without giving me time to translate the Spanish into English. In essence, I bypassed visual images of the printed words, mimicked what I "heard" or lipread, and responded "muy rapido."

I also lived with a Spanish-speaking family,which meant that there was no one who spoke English to help me; it was just me with my Spanish/English dictionary out there. After six weeks of this total immersion, I found myself dreaming in Spanish. Later I managed to live by myself in Madrid for a few weeks without English interpreters. This experience has led me to think that a new auditory pathway/neuronal network was developed at this late age of 18 years. Admittedly, my Spanish has atrophied from non-use since that time. There is no question that I had learned to lipread in Spanish, but I distinctly remember "hearing" the timbre and crisp words being rattled off by my teacher. After one of these breathtaking rapid-fire sessions, he paused to call me "a perfect mimic." The intonation and timbre of these phrases had to come from the ear.

With this personal perspective as someone with a hearing impairment who learned to utilize his hearing in a variety of situations, I believe that it is logical for an adult to more rapidly restore and maximize his or her residual auditory skills with intensive rehabilitation after getting a cochlear implant. It is well known that the adult brain has "plasticity," the capability to undergo learned changes or adaptive responses. Directed repetitive stimuli or "auditory experience" should facilitate restoration of neuronal pathways for improved auditory comprehension following a cochlear implant in the postlingually deafened adult.

While everyone recognizes the need to provide therapy to children with hearing loss, there seems to be an assumption that we "outgrow" the need for therapy. Actually that is not true. Most hearing impaired adults can benefit from therapy, especially when they receive a change in amplification or receive a cochlear implant. As hearing aids and cochlear implants are used to provide that change, more auditory information becomes available to the hearing impaired person. A change in the auditory signal requires that the listener's brain "relearn" what to expect and how to interpret new information. While some learning occurs naturally just by listening, most people find that an organized auditory therapy program will speed up the learning curve and assist the person in making maximum use of the new auditory information. With adults, these programs are usually short term, but they may be repeated periodically as the need arises.

Auditory rehabilitation uses training strategies to develop focused listening skills and auditory comprehension. Therapy progresses from simple listening tasks to more complex ones working through a hierarchy of tasks. The hierarchy begins with discrimination of the presence or absence of sound. The second level is identification of specific sounds and words. The third level is recognition of specific linguistic information, beginning by using direct clues (using a selection of known words or sentences which may vary in length to make recognition easier), moving on to using indirect clues (such as giving a topic to be discussed—for example, "time," "vacation," etc.) and finally moving into tasks with no clues. The fourth level of therapy involves comprehension tasks which require that the listener work to understand complex materials. At this level, within each set of tasks the clinician will work out exercises which begin with words, sounds, and sentences that are very different from each other in frequency, length, and pattern. As the listener's skills improve, therapy will expand to include words and sentences that are more similar and have fewer clues to distinguish them, thereby making listening more difficult.

Therapy tasks include speech tracking, in which the listener repeats sentence and paragraph material read by the therapist, question/statement discrimination tasks, and telephone practice. Some therapy time may be directed to group activities,which provide support from other cochlear implant patients and for their families. Support is also provided by online chat groups.

Despite our belief in improved aural function after auditory rehabilitation, we are aware that there are no recent studies demonstrating such outcomes. This is mostly due to the fact that studies have not been performed or published. In our Center, this is an area of ongoing research, which hopefully will provide information about the efficacy of auditory rehabilitation after adult cochlear implantation. We are currently trying to determine which strategies are the most appropriate ones for adults with cochlear implants, and trying to determine which cochlear implant recipients are most in need of rehabilitation services.

Nevertheless, based upon our experience with aural rehabilitation with hearing aids and the concept of neural plasticity, we believe that properly focused aural rehabilitation will expedite enhanced auditory function in adults after cochlear implantation. If Ms.Whitehurst were to return today to see the progress children and adults have made following cochlear implantation and intensive rehabilitation, I would see a *deja vu* in her smile and a twinkle in her eyes.

Paul Hammerschlag, M.D., performs cochlear implant surgery and is Associate Professor of Otolaryngology at a medical school in New York City. He serves on the board of The League for the Hard of Hearing and the national board of Self Help for Hard of Hearing People. Dr. Hammerschlag has a severe-to-profound hearing impairment.

Jane Madell, Ph.D., is the Director of The Hearing and Learning Center at Beth Israel Medical Center. She has a special interest in the effect of cochlear implantation on central auditory processing. Dr. Madell's most recent book is "Behavioral Evaluation of Hearing in Infants and Young Children " (Thieme, 1988).