

Cochlear Implants – A Personal Perspective

by Simon C. Parisier MD

In May, Simon Parisier, MD was invited to speak at the University of Maryland – School of Medicine (Department of Otolaryngology) Graduation Celebration. In his speech below, Dr. Parisier brings you through the history of deafness and reveals how this journey changed, not only his life, but the lives of so many deaf children and adults.

It is 1976 and I'm a young Otologist, 10 years out of residency. The pediatricians ask me to consult on a young child being treated for bacterial meningitis. The perfectly healthy child developed a high fever, a headache and has been comatose. She has responded to high dose intravenous antibiotics and is getting better. However, her developing speech is now garbled and incomprehensible. She doesn't seem to respond to sound. Her balance has been affected. The parents say, "Doctor what's happening? Please help her." I explain that the bacterial infection has spread to the child's inner ears and has deafened her. Without hearing, the speech she had developed as a three year old has disappeared. I have to say, "I'm so sorry but your child is profoundly deaf..." I compassionately answer the many unanswerable questions as to what lies in store for their previously perfect child. This experience made me, the young otologist, feel helpless, frustrated and inept.

Historically, what happened to profoundly deaf children?

In 1771, Charles Michel L'Abbe de L'Epee, took shelter during a rain storm in a house inhabited by two deaf sisters. In the warmth of the kitchen, he recognized that though they could not talk, they communicated using meaningful gestures. He developed a natural language composed of signs based on the insights he gained from watching deaf subjects and started the first public school for the deaf in Paris. A royalist, his mission was jeopardized by being jailed during the French Revolution but he kept his head and was eventually freed by Napoleon.

Coincidentally, in Connecticut, a physician who had a 7 year old deaf daughter asked his friend and neighbor, The Reverend Thomas Gallaudet, for help in finding a way to educate his child. Traveling in Europe to study methods for teaching deaf students, Reverend Gallaudet visited "L' Institut National de Jeune Sourd de Paris", The French School for the Deaf, and was introduced to Laurent Clerc, a teacher and highly educated student of the L'Abbe. The Reverend studied methods of manual communication and learned sign language from Clerc. Together, they returned to Connecticut and in 1817 founded "The Hartford Asylum for the Education of the Deaf and Dumb" Four years later it was renamed "The American School for the Deaf". The Doctor's deaf daughter, Mary Coswell, was one of the first students. Interestingly, The Reverend's son, Edward Gallaudet, in 1864, founded the first college for the deaf in Washington DC – Gallaudet University.

In the mid nineteenth century, educating deaf children using sign language was controversial. Oralists, who condemned the use of sign language, trained deaf children by having them touch the teacher's face, throat and chest to feel the vibrations of sound. Their goal was to have deaf children develop understandable speech and to acquire lip reading skills. Alexander

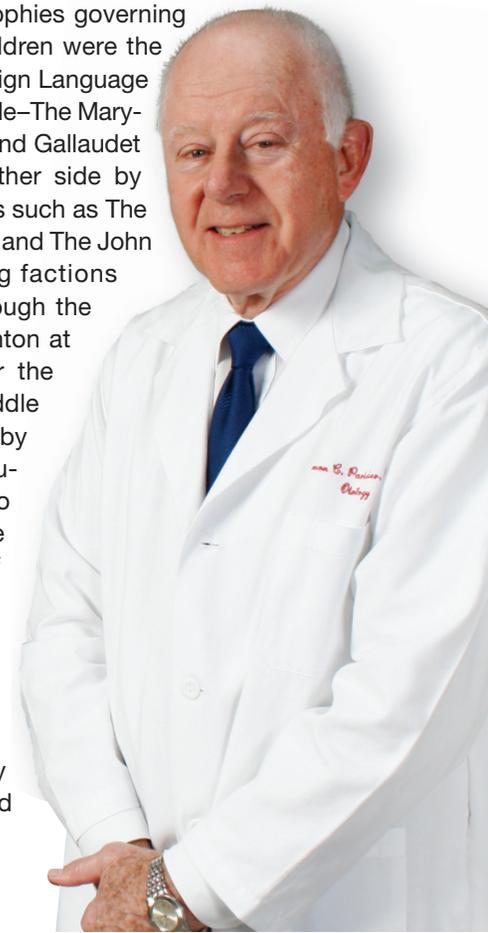
Graham Bell's mother and wife were deaf. His Grandfather, father and uncle were elocutionists who taught the art of public speaking. His main interest was to help the deaf develop speech and find ways to overcome this handicap. He invented a voice spectrograph, creating a visible record of speech to assist his deaf wife's communication abilities. His further experiments with hearing devices culminated in the US Patent for the Telephone in 1876 and the creation of ATT.

The conflict between the proponents of sign language and the defenders of oral communication came to a head in Milan, Italy, at "The Second International Congress on Education of the Deaf" held on September 6-11, 1880. A declaration was made that oral education was better than manual education and a resolution was passed banning sign language. The only two countries to oppose the ban were the United States, who was represented by the Gallaudets, both father and son, as well as Great Britain.

We skip forward to post World War Two; the miniaturization of batteries and vacuum tubes resulted in the development of powerful body-worn hearing aids. These aids were the size of a cigarette pack and had wires that connected to ear molds. They were touted as being able to provide sufficient amplification to effectively provide hearing to the deaf, which in turn would enhance their speech, language, and educational achievements and consequently their employment opportunities. Thus, it was assumed that a hearing impaired person of normal intelligence would benefit from this technological breakthrough. Parenthetically, if deaf people did not succeed, it was their problem!

The two opposing philosophies governing the education of deaf children were the proponents of American Sign Language on one side by – for example–The Maryland School for the Deaf and Gallaudet University, and on the other side by prestigious oral institutions such as The Clarke School for the Deaf and The John Tracy Clinic. These warring factions remained polarized through the years. In 1967, David Denton at The Maryland School for the Deaf tried to find a middle ground between the two by formulating "Total Communication". This approach to deaf education makes use of a number of modes of communications such as sign, oral, auditory, written and visual aids depending on the particular needs and abilities of the child.

So, how did the profoundly deaf do educationally and



economically? Unable to hear, the speech development of these children was severely affected and they experienced serious language delays. Indeed, the average graduate of a deaf high school had a third grade reading ability and a fourth grade computation skill. Shockingly, only forty percent graduated high school. The profoundly deaf individual earned the lowest income compared to all other disabled individuals.

The development of the cochlear implant began in the early 1950's when a French Neurophysiologist, Andre Djourno, convinced an otologist, Charles Eyries, to insert a gold electrode with an induction system into the inner ear of a totally deaf patient with a facial paralysis who was having revision cholesteatoma surgery. When electrically stimulated, the patient heard! They followed up with similar experiments in several additional patients with short-lived successes. Their relationship ended on a somewhat bitter note over a disagreement as whether to partner with industry in order to obtain necessary funding that could be used to develop a more sophisticated, reliable device... academia should not be tainted by commercialization!

It is of interest that the development of cochlear implant technology has benefited from joint ventures between University and Industry. 3-M manufactured and marketed the House single channel implant. Advanced Bionics' Alfred Mann developed the multi-channel Clarion Implant jointly with the University of California, San Francisco. Ingebord and Irwin Hochmair worked cooperatively with the University of Salzburg to develop the Med-El cochlear Implant. Graeme Clark working with the University of Melbourne in Australia developed the Nucleus cochlear implant (Cochlear Corporation). Perhaps, if the French team, in the 1950s, had the vision to work in concert with industry they might have achieved better results.

A patient brought Dr. William House a published report from a French Journal describing Djourno and Eyres experiences. Over the next 10 years, Dr. House in collaboration with Jack Urban, an engineer, developed a single channel, wearable cochlear implant. At the same time, Dr. Robin Michelson working with Michael Merzenich, a neuroscientist, developed a multi-channel cochlear implant at the University of California, San Francisco. However, in 1972, at the "First International Conference on Stimulation of the Acoustic Nerve" there was serious scientific intellectual opposition. The neurophysiologist's dogma, based on animal experiments, was that when an inner ear hair cell died, retrograde degeneration of the affected auditory nerve fibers ensued. This meant that it would be impossible to electrically stimulate a degenerated nerve. These scientists surmised that the implanted patients were receiving vibro-tactile stimulation rather than hearing. They concluded that cochlear implants would not work.

In 1975, the National Institute of Health sponsored an independent evaluation of the efficacy of cochlear implants that was conducted by RC Bilger, PhD at the Pittsburgh Eye and Ear Hospital. The hearing of the 13 patients that Drs. House and Michelson had implanted was methodically studied. The report confirmed that these patients were hearing electrically produced sounds. Cochlear implants were legitimized and a new era was born!

One would think that the deaf would welcome this remarkable development that could restore hearing. This was not the case. Remember the story I mentioned: the powerful hearing aids that were the size of a cigarette box, which were developed after World War II that would make deaf people hear? Well, now the same otolo-

gists and audiologists were spinning the same story and saying that deafness could be cured by a new technology called the cochlear implant. The early cochlear implants were also the size of a cigarette box worn on the body with wires that went to transmitting coils worn behind the ears, closely resembling the earlier hearing aids which had failed to benefit them. They considered new implants to be even worse since they required mutilating surgery. As Abraham Lincoln said, 'Fool me once, shame on you. Fool me twice, shame on me'.

The Deaf Culture was outraged! They have their own language – American Sign Language – and they adhere to the politics of Deafness. Meaning... They do not consider themselves as being broken or disabled and do not need to be fixed. They feel that the hearing world has ostracized them as "deaf and dumb" –because they are different, they are excluded. In addition, deaf children born to hearing parents who have no familiarity with deafness should allow their children to be enculturated and embraced by the deaf culture in a deaf environment. Finally, they say that rather than face the painful, damaging rejection of the hearing world, deaf children should be made a part of the more accepting deaf world where they naturally belong.

Over the next 20 years there was a great conflict between proponents of cochlear implants who considered deafness to be a disability and members of the deaf culture who viewed themselves as an endangered alternative society. International Cochlear Implant Meetings were picketed and disrupted. Accusations were made that by forcibly enculturating defenseless deaf children into the hearing world – genocide of the deaf culture was being carried out.

At present, the efficacy of Cochlear implants has been proven and is no longer controversial. Grudgingly at first, the deaf culture has accepted these advances. Most schools for the deaf have incorporated cochlear implant programs into their early intervention programs. Bilingualism has been accepted. A deaf child born to deaf parents who has hearing restored by a cochlear implant can develop fluent English language skills and be educationally mainstreamed while simultaneously using American Sign Language skills to communicate with profoundly deaf parents, grandparents and other member of the deaf culture.

Today, much like the Salk vaccine led to the eradication of Polio, Cochlear Implants is eliminating profound deafness. The passage of a Federal Law requiring Universal Newborn Hearing Screening has proven to be highly effective for the early detection of a hearing loss. When a significant hearing loss is detected, the infant is fitted with hearing aids. If the child does not hear even with the most powerful aids, a cochlear implant can be performed at 6 to 12 months of age. The auditory input provided by a cochlear implant stimulates the development of the brain's auditory centers. Additionally, in conjunction with the cochlear implant, deaf children who are provided with the necessary supportive environment develop normal language and speech capabilities. They are able to succeed in the mainstream and to achieve equally to their hearing peers.

Now, when I see a profoundly deaf infant, I no longer cringe at the bleak outlook that this child faces. With conviction, I can promise the parents that this problem can be overcome and that their child will be able to develop and achieve a normal and successful life, both academically and socially.