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# Unilateral Hearing Loss

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One of the interesting things about losing my hearing over time is that I have experienced many different variations of hearing impairment. I have gone from having normal hearing in my early childhood, to a mild hearing loss with amplification and finally now with profound deafness. I have a cochlear implant for my right ear and a hearing aid on the left.

The purpose of my hearing aid is to provide me with low frequency information. This improves my perception of music, and makes people's voices sound richer and more natural. However, my word recognition score in my left aided ear is 0%. The things that I continue to find frustrating are as follows:

1. Inability to understand speech from my left side. I always have to make sure people are speaking directly in front of me or on my right side. If people are on the left side, the head shadow blocks some of the energy of the consonants from reaching my right implanted ear.
2. Loss of localization. Anytime someone calls my name I look to the right, regardless of the actual location. The elevators at the parking garage at the airport in Toronto have three elevators on one side and three on the opposite side. When one of them arrives I need to do a pirouette like a ballerina to try to visually see which elevator arrived. Needless to say, I have missed quite a few.
3. Hearing in Noise. Even a directional microphone at ear level is insufficient.

Looking at these three complaints, I realized that these are the exact same challenges faced by people with unilateral hearing loss (UHL). Valente describes the three main consequences of UHL as (1) localization, (2) understanding speech arriving at the poorer ear, and (3) understanding speech in background noise.[1] Fortunately for me I have embraced the use of wireless microphones which helps with the head shadow effect and speech understanding in noise issues, but it does not address the localization problems. However, I have a developed an appreciation for what it must be like to experience a UHL. From a functional perspective, having only one working ear is challenging.

There are consequences to untreated UHL. Leui conducted a literature review of the impact UHL has on the development of speech, language and educational achievement.[2] Analyses of the various articles revealed that 22 to 35% of students with UHL repeating at least one grade. Moreover, 12% to 41% of students with UHL required additional educational assistance. Other studies have shown that children with UHL are at risk for difficulties with their speech and language development and their educational achievement. For example, Bess et al found that 54% of students in the United States with UHL receive special education services.[3] Lieu, found that children with UHL are at risk for speech and language delay, educational difficulties, and a lower quality of life than peers with normal hearing.[4]

Adults suffer from consequences of UHL as well. Wie, Pripp and Tvete examined the effects of UHL in adults, particularly the effects on communication and social interaction.5 Their data found that 93% reported that hearing loss affected communication and 87% reported problems with speech perception in noisy settings. Other consequences were feelings of exclusion, reduced well-being, and extensive use of speech perception strategies.

There are a range of treatment options for UHL. These include CROS/BiCROS systems, wireless microphone options, sound field systems, bone conduction hearing aids or bone anchored hearing aids (BAHA) on the unaidable ear, and even cochlear implantation.

In the past, I often counselled patients to pick a solution based on their described problems and needs. For example, if the head shadow effect was the main complaint, I often suggested a CROS or BiCROS solution since this would allow speech to be intelligible from both sides of the head. If hearing in noise, over distance, or in reverberant environments was the main complaint, I often recommended a wireless microphone to be worn by the communication partner in a car, restaurant, or other noisy environment.

In the past, the use of a CROS system may have actually decreased the patient's ability of communicate in background noise. Valente described it well in the following quote: "when we fit a CROS hearing aid, we place a microphone over or in the poor ear to capture the wanted signal the patient was missing. However, there is a strong likelihood that noise will arrive on that side as well. This noise, which in the past was attenuated by the patient's poor hearing, is now amplified and sent to the better ear. Thus, the well-intentioned practitioner has reversed the patient's unaided world. What was 'difficult' without amplification becomes 'easier' (i.e., speech on the poor side), but what was 'easier' without amplification now becomes more difficult (i.e., noise on the poor side). Thus, the use of amplification has reversed the patient's world by making 'easy listening' difficult and 'difficult listening' easy."[1]

Today, the performance of the CROS and BiCROS option has improved. For example, some hearing instrument manufacturers now have the ability to stream in real-time the full audio bandwidth between the hearing aid and the CROS microphone. This now allows the person to hear through a multi microphone adaptive binaural beamformer which produces a highly focused directional beam toward the front. Functionally, this will give individuals with UHL take better understanding of speech in one-to-one conversations in a diffuse background noise.

Schafer et al looked at the effectiveness of a modern CROS system in 24 patients with UHL.[6] Using the APHAB, difficultly was reduced across 3 subcategories of the APHAB, specifically reverberation, ease of communication and noise with the modern CROS system. On the Speech Spatial and Qualities of Hearing (SSQ) questionnaire, significant improvement was seen with the CROS across all three subscales. On the Auditory Performance Scale for Single-Sided Deafness (APS-SSD), subjects reported significant reduction of difficulty when the CROS was in use across all three listening domains: home, work and social situations. On AzBio speech in noise testing, the CROS and BiCROS resulted in significant improvement in listening in noise when the noise was directed to the unaidable ear.

A final option is the use of wireless microphones. These devices have the advantage of both overcoming the head shadow effect and improving hearing in noise, although it does not help with the problem of localization. For children in the classroom with one normal ear and an unaidable ear, there are comfortable ear level receivers available. For children with a normal ear and hearing loss in the other ear which is still aidable, I usually recommend both a wireless receiver for the normal hearing ear, and a hearing aid with a receiver for the hearing loss ear. Finally, for children with a hearing loss in both ears where one ear is unaidable ear and the other has usable hearing,

then I have recommended amplification in the aidable ear only along with a wireless system coupled to this hearing aid. For this latter condition, one could also consider a CROS microphone on the unaidable ear as well.

Options for reducing the negative consequences of UHL definitely exist. Although care must be taken to ensure that the treatment option chosen is carefully selected and produces the desired functional outcome, there is no need to ignore treating UHL.

## References


1. Valente M. Fitting options for adults with unilateral hearing loss. Hear J 2007;60(8).
2. Lieu J. Speech-Language and educational consequences of unilateral hearing loss in children. Arch Otolaryngol Head Neck Surg 2004;(130): May.
3. Bess FH, Klee T, and Culbertson JL. Identification, assessment, and management of children with unilateral sensorineural hearing loss. Ear Hear 1986;7(1):43–51.
4. Lieu J. Children with unilateral hearing loss, Semin Hear 2010;31(4):275–89.
5. Wie OB, Pripp AH, Tvete O. Unilateral deafness in adults: effects on communication and social interaction. Ann Otol Rhinol Laryngol 2010;119(11):772–81.
6. Schafer, E, Baldus, N, D'Souza, M. Behavioral and subjective performance with digital CROS and BiCROS hearing instruments. J Rehabil Audiol 2013 XLVI 62–93.