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HIDDEN HEARING LOSS

Official Publication of Hearing Assessment Center



WHAT'S INSIDE THIS ISSUE:

What is hidden hearing loss? Why does it happen?

What are the implications?



HIDDEN HEARING LOSS

by Dr. Donald Guillen

Imagine that you're at the local pub, celebrating one of your friend's birthdays. Everyone is talking, joking, and laughing around you but you're having a hard time understanding what they're saying. By this point, you've asked "What?" with what feels to be the millionth time. You become so frustrated that you begin to tune out of the conversation completely.



In the back of your head you think to yourself, "I just had a hearing test that showed normal hearing, why am I struggling so much?" This is an important question and one that creates the need for clarification.



HIDDEN HEARING LOSS

What actually constitutes normal hearing? Is it really a matter of having access to adequate loudness or volume levels? What about individuals who do well in most situations but struggle mightily in areas that have even the slightest amount of competing noise as in the case mentioned above? Newer research developments have allowed for a more thorough understanding of our hearing system, and in particular, have opened the door into exploring the difficulties experienced by individuals with what is known as hidden hearing loss. More formally, it is known as cochlear synaptopathy.

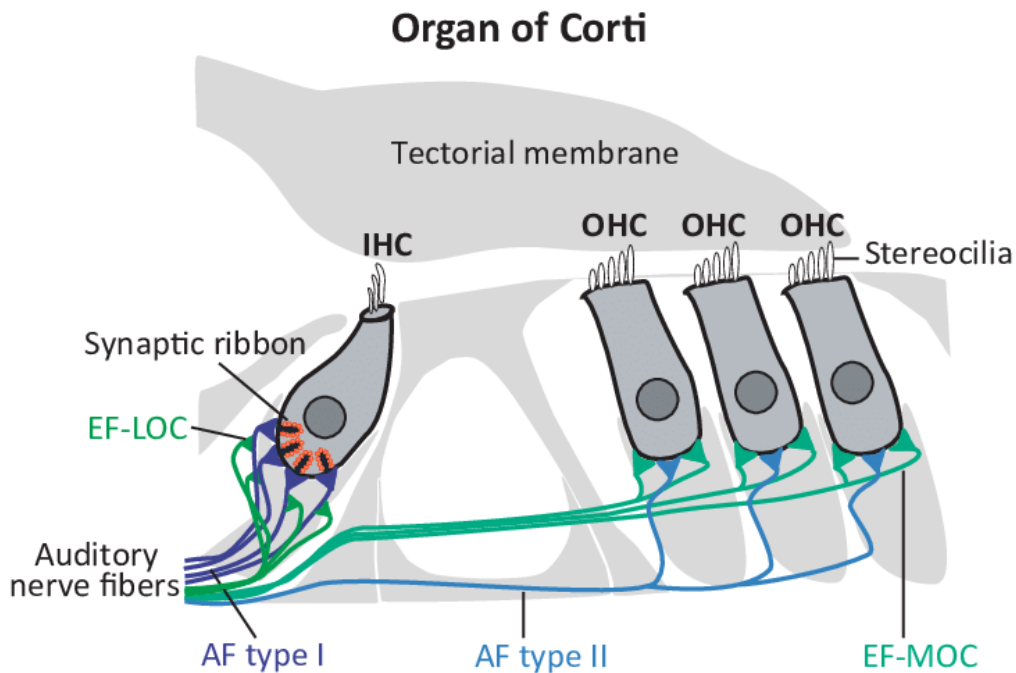
Hidden hearing loss occurs when a patient presents with trouble understanding speech in noisy situations but whose audiometric or hearing thresholds are within normal limits. This condition is much more complex to treat than traditional hearing loss. The reason for this is that individuals suffering from hidden hearing loss are typically told they have “normal hearing” despite their reported difficulties. Their speech in noise deficits are “hidden” by their normal audiometric thresholds. In essence, it is mainly a clarity problem and not a loudness issue. As a result, they can remain under the radar as likely treatment candidates. For most, it isn't until speech in noise measures are performed that they are counseled and have their listening difficulties validated.

For a long time, it was assumed that sensorineural hearing loss (the most common form of hearing loss) started exclusively with deterioration of the auditory nerve endings known as cochlear hair cells (stereocilia). This type of deterioration has been widely accepted as causing difficulties primarily relating to loudness or volume levels. Classic presentation of this type of loss is consistent with thresholds that are outside of the normal range with relatively preserved speech understanding abilities. While this is one of the more common forms of sensorineural hearing loss it does not show the complete picture.



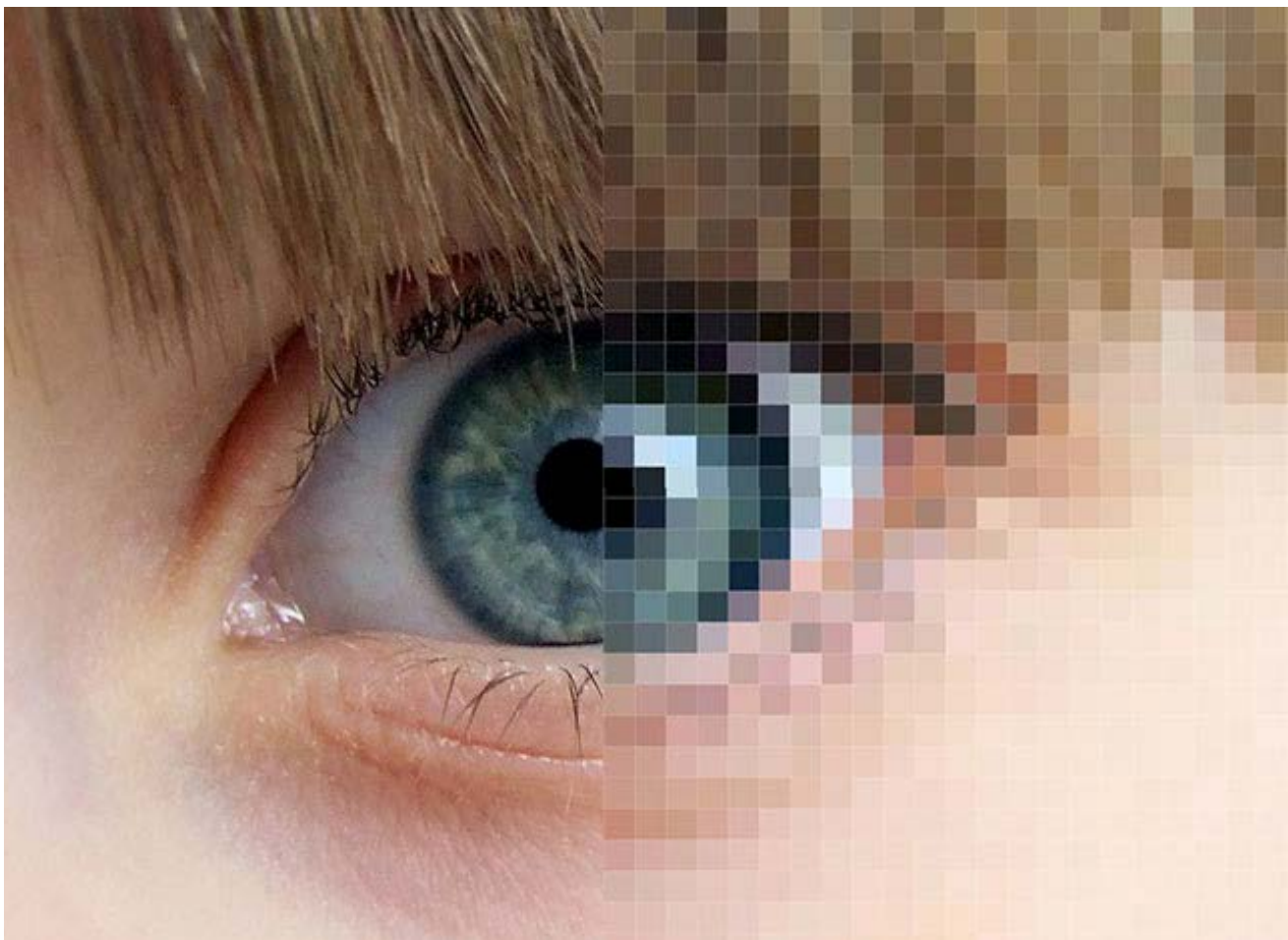
HIDDEN HEARING LOSS

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Advances in technology have allowed for further exploration into the Organ of Corti, and in particular to visualizing and identifying the smallest of components that comprise this structure. What researchers have found and detailed over the past decade are that there are actually nerve fibers known as ribbon synapse fibers that actually connect the outer and inner hair cells to the actual auditory nerve itself (highway to the cortex for processing). These ribbon synapse fibers serve as actual information channels. The more of these information channels, the more input and information your auditory nerve is able to send to the brain for signal processing and interpretation. The removal of these information channels, either through age-related neuro-degeneration or noise-induced trauma, is equivalent to the downsampling of a visual image as shown below.

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HOW IS HIDDEN HEARING LOSS DEFINED?

Usual clinical presentation of hidden hearing loss consists of hearing within normal limits (audiometry) accompanied by both significant hearing handicap perception and compromised speech in noise scores on measures such as the Quick Speech-in-Noise (QuickSIN) test or the Hearing in noise test (HINT).

More recently, the use of pupillometry (eye dilation as a function of cognitive load/strain) and electroencephalogram (EEG) testing is being implemented in research labs to measure the effect of this type of hearing loss on our brain function. The hope is to one day be able to show the degree to which these information channels, if damaged, can affect our cognitive function over time.

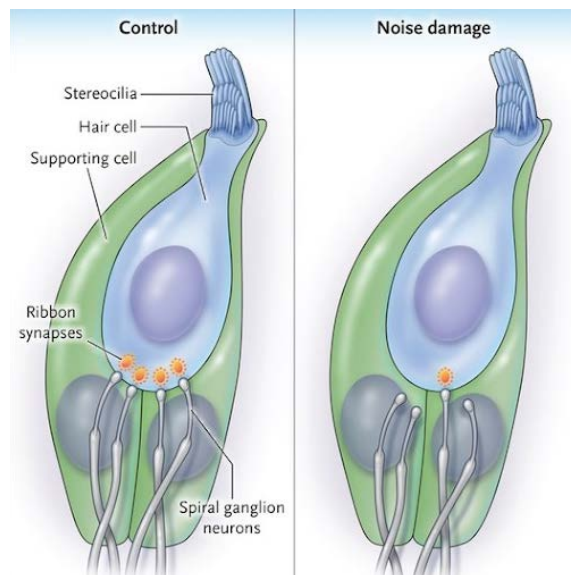


Currently, testing for hidden hearing loss consists of standard audiometry, speech in noise measures, and the use of subjective tools such as the hearing handicap inventory. These tests are able to isolate and identify suspected sites of lesion as it pertains to hearing impairment.

WHAT CAUSES HIDDEN HEARING LOSS?

The most common causes of Hidden Hearing loss or Cochlear Synaptopathy are noise trauma and age-related neuro-degeneration. Those with military experience are especially at risk for developing this condition. Many veterans returning from combat report significant difficulties with speech understanding in noisy environments like the pub we described at the start of this paper. These individuals will also typically develop tinnitus perception or ringing in the ears in conjunction with these difficulties.

Firefighter personnel and all those working around industrial noise are at risk. Age-related degeneration or degradation of information channels is another common cause of hidden hearing loss. However, in these individuals, there traditionally is also a compromise to not just the information channels (ribbon fibers) responsible for clarity but also to the stereocilia component of the hair cells responsible for loudness perception. Thus, the difficulties these individuals exhibit are typically validated by the clinician evaluating them since a physical hearing loss is measured on the audiogram.



WHAT TREATMENT OPTIONS EXIST TO HELP?

Individuals dealing with clarity issues consistent with Hidden Hearing Loss or Cochlear Synaptopathy require substantial auditory support. These individuals benefit remarkably from treatment that can provide the cleanest and most precise signal input to the ears so that the brain, already compromised by the very fact that it is receiving decreased information from a smaller number of synaptic channels, can process and interpret the information more easily.



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FURTHER CLINICAL IMPLICATIONS?

With more and more studies investigating the relationship between hearing loss and cognitive decline, it is crucial to understand what effect hidden hearing loss has on our brain health long term. We now understand that when the brain has to work harder long term (cognitive strain/load), by focusing intently on trying to hear versus actually hearing, this leads to cognitive fatigue. Long term brain fatigue then leads to cognitive impairment or decline. Thus, identifying and addressing these clarity deficits early is crucial to maintaining your brain and cognitive health.



References

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Age-Related Cochlear Synaptopathy: An Early-Onset Contributor to Auditory Functional Decline

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Journal of Neuroscience 21 August 2013, 33 (34) 13686-13694; DOI: 10.1523/JNEUROSCI.1783-13.2013



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