EARMOLD ACOUSTICS AND THEORIES

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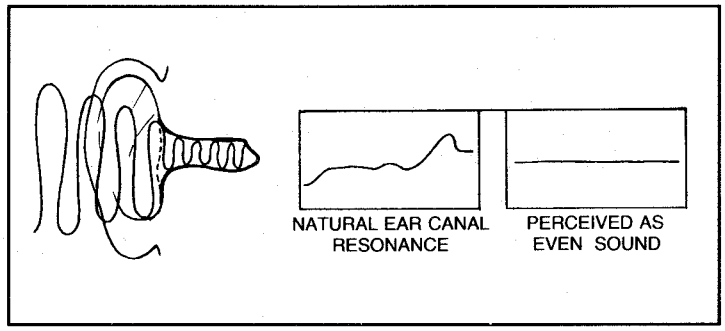
Earmold Acoustics is the marriage of the physics of sound and the measurement of sound as it passes through an earmold. The reader of this catalogue is referred to textbooks and the hearing aid journals for detailed information on the vocabulary and concepts of earmold acoustics.

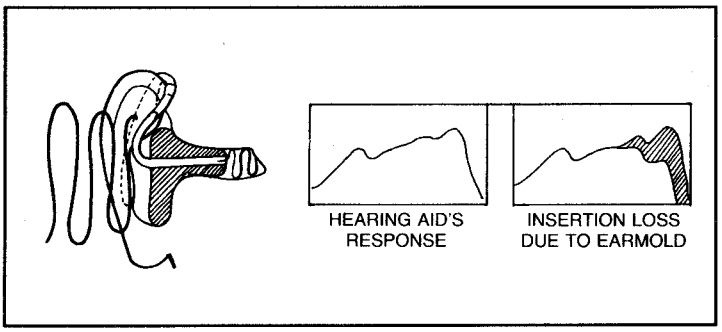
We shall cover the basics of what you, the dispenser, need to know about this area of earmold technology. The first of these measurements you should know about is the effect of the shape of the human ear canal. The shape of the canal creates a resonating cavity that has the effect of changing incoming sound by boosting the sound around 2600 Hz by a significant amount.

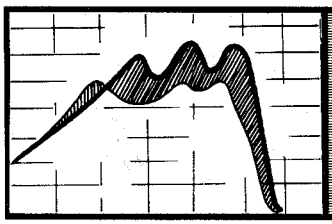
Natural Ear Canal Resonance



The second measurement you should know about is a measurement of the energy spectrum of normal human speech. The measurements show that the low frequency sounds (vowels) carry the energy of speech while the high frequency sounds (consonants) carry the information of speech. This is important in fitting hearing aids because it stresses the need to emphasize the higher frequencies in most fittings. The third measurement that has a profound effect is what happens to ear canal resonance when you, the fitter, install an earmold in the ear? The graph below shows "Insertion Loss".

Insertion Loss





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Now let us look upon what happens in the earmold itself. There is a mass of air particles in the hearing aid's sound transmission system which includes the ear hook, the tubing, the drilled bore and any additional channels like vents or resonating cavities. Each of these areas will have an effect on the hearing aid's final output. This sound channel affects frequency response the most. It is possible to control the frequency response by changing the sound channel in three major ways. These are venting, the use of dampers and the use of horn effect.

Venting allows sound to escape out of the ear canal by the creation of a hole from the ear canal to the outside air. Dampers have as their goal the smoothing of the hearing aid's frequency response by inserting a resistant material in the earhook or tubing. Horn Effect is just what the name states; by creating a "belled" bore, it is possible to preserve high frequency response when compared to a "straight" bore. A more detailed description with graphs will be presented in the section of this catalogue entitled "Earmold Selections".

The problem of an earmold creating insertion loss caused several researchers to experiment with creating Helmholtz-type resonators in the earmold's body. In its essence, a Helmholtz Resonator takes a given amount of acoustical energy passing by and redistributes that energy by frequency. There are today, several earmold configurations in this catalogue which can help solve the insertion loss problem because these special configurations contain Helmholtz-type resonators.

The reason acoustically, that you the fitter will have to have some background in earmold acoustics, is that the current hearing aid transducers are high impedance devices and the eardrum is a low impedance system. This mismatch of impedances requires you to "control" the sound's passage through the earmold system to achieve the best results.