Otolens
Invisible In Canal Hearing Aids
Size matters…

• DID YOU KNOW?...
• Hearing aid sales increased dramatically in the mid 1980s as a result.
Deep canal hearing aid fitting

- **Staab, WJ:** *The peritympanic instrument: fitting rationale and test results.* Hearing J 1992; 5(10):21-26
- **Staab, WJ, Finlay BA:** *Fitting rationale for deep fitting canal hearing instruments.* Hearing Instruments 1991; 42(1):6-12, 48
- **Gudmundsen, GI:** *Fitting CIC Hearing Aids, Some Practical Pointers* Hearing J, 1994; (7): 10, 45-48
- **Killion MC, Wilbur LA, Gudmundsen G.** Zwislocki was right…a potential solution to the “hollow voice” problem the amplified occlusion effect with deeply sealed earmolds. Hearing Instruments. 1988; 39: 14-18
- **Staab, WJ, Martin, RL:** *Taking Ear Impressions for Deep Canal Hearing Aid Fittings.* Hearing J 1994; (11) 19-28
Invisible In Canal Hearing Aids

- **Goal:** develop a custom deep insertion canal aid that resides beyond the 2nd bend
- **Goal:** use advanced digital modeling and advanced micro-chip packaging techniques to minimize overall size.
What are Invisible In Canal Hearing Aids?
What has changed today?

- **Better circuit** options
  - Feedback reduction
  - Noise reduction

- **Better shell** manufacturing techniques
  - Digital shell modeling and fabrication
  - Optimization of circuit component location
  - Deep faceplate placement, invisible
Fitting: Advantages of deep canal fittings

- Smaller residual volume, more efficient coupling
- Deep seated canal tip reduces occlusion
- Microphone location makes use of natural canal and concha resonances preserving localization and spatialization cues
Pinna and external canal resonances

Ear canal Resonance
Pinna Effect
Total Pinna and Canal
Benefits to spatial hearing come from access to spectral cues.
Unaided, IIC, and BTE (KEMAR) Directivity Indexes

The graph shows the directivity indexes for Unaided, IIC, and Omni BTE conditions. The y-axis represents the Directivity Index (dB) ranging from -5 to 6, while the x-axis represents frequency in Hz ranging from $10^2$ to $10^3$. The graph compares the performance of these conditions across different frequencies, with Unaided, IIC, and Omni BTE conditions indicated by distinct lines.
Figure 2. Four completely-in-the-canal (CIC) hearing aids used for occlusion measurements, differing in length from 12 mm (D) to 21 mm (A).

IIC vs. CIC
Resonance effects of deep CIC’s

Integrated Real Ear RECD from Data Warehouse compared to averages from the literature

- Seewald et al DEEP CIC
- ITE/ITC Bentler and Pavlovic
- CIC Data Warehouse (n=1300)
- non-CIC custom RECD Data Warehouse (n = 370)
Who are candidates?

- Customers who:
  - Desire sound fidelity
  - Struggle in noisy conditions
  - Feel Occluded
  - Won’t wear visible hearing aids
  - Are willing to have the impression taken
  - Have good dexterity and understanding of insertion/removal

35 dB of gain (2cc coupler) ...can produce as much as 60dB In-situ
Recent revision accepts that deep impressions may be appropriate:

“Some devices, such as “completely-in-the-canal” or C.I.C. aids, require a particularly deep impression that reaches some distance beyond the second bend and into the bony part of the canal. It is strongly recommended that particularly deep impressions are only undertaken by someone who has received appropriate training. “

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Common Sense Safety Precautions

- Use the proper tools for the impression
  - Impression materials (More viscous)
  - Bright LED probe light
  - Vented oto-stops
  - Lubricants
- Know the specific anatomy and history of the ear you are about to work with
- Observe cleanliness and infection control practices
- Use recommended bracing techniques with any tool in the ear
A probe tube may be placed in canal with the cotton dam to facilitate pressure equalization upon removal of cured impression.
Vented Oto-Dam
Sizing Gauge

- Impression Measurement Gauge / Key
Fitting

- In-Situ audiometry - Understand the acoustic effect of the individual ear
- Longer fitting strips
- Stronger removal handle (5 x Stronger)
- Visual appearance often appears unusual!
- Daily cleaning and maintenance
Anybody out there?