Open Ear
Hearing Aid Fittings
Open Fittings

- Reasons for fitting open hearing aids
- Occlusion
- Life fittings
- Probe Mic Considerations
- Directional effect
- Match to target
Siemens Life™ open ear BTEs

The most advanced technology available, designed for discreet and open fittings
Industry Product Mix (USA)

Shifting towards BTEs

<table>
<thead>
<tr>
<th>Year</th>
<th>Custom</th>
<th>BTE</th>
</tr>
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<tbody>
<tr>
<td>2003</td>
<td>76%</td>
<td>24%</td>
</tr>
<tr>
<td>2004</td>
<td>74%</td>
<td>26%</td>
</tr>
<tr>
<td>2005</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>1st Qtr 2006</td>
<td>58%</td>
<td>42%</td>
</tr>
<tr>
<td>2nd Qtr 2006</td>
<td>56%</td>
<td>44%</td>
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</tbody>
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Reasons for fitting open ear hearing aids

- Reduced occlusion effect
- Improved sound of own voice
- More comfortable fit
- Improved speech quality
- Improved cosmetics
- Ease of delivery/fitting
- Reduced returns
- Reduced return visits for service
- Easier for patient to insert/remove
- Improved localisation

Johnson and Mueller, Hearing Journal 2006
Reasons for fitting (Top 8)

Source: BHI Thin-Tube Survey, 2006
Reasons for fitting (Bottom 8)

- Instant fit
- Less returns
- Responded to AD
- No ear impression
- Customer recommendation
- More power
- Colors
- More controls

Source: BHI Thin-Tube Survey, 2006
Likelihood of purchasing hearing aid in absence of thin tube Mini-BTE

- 22% would **not** have purchased anything.
- Would have been fitted instead with:
  - BTE (12%)
  - Mini-BTE (14%)
  - ITE (7%)
  - ITC/CIC (46%)
Who is a candidate for open products

- High frequency hearing loss
- Moderate flat – sloping loss
- Patients with cosmetic concerns
- Previous CIC users with occlusion issues
- Patients with a “small hearing loss” seeking a “small hearing aid”
Selection/Fitting Issues

- Fit with open thin-tube
- Fit with custom earmould
- Fit with S-Tube to access volume control and memory button
  (mini BTE models)
Occlusion

Figure 3. The measurement of the hearing aid occlusion effect for the “ee” vocalization by the patient. Shown is the open-ear SPL, with the resulting occlusion effect for an open-canal fitting tip and for a closed earmold.

Mueller & Ricketts, Hearing Journal, 2006
Mean and range of occlusion-effect

Mackenzie, Hearing Journal, 2006
Figure 4: Mean ratings of own-voice sound quality (1= very hollow; 10=very natural) for each of the three OC tube systems.

Mackenzie, Hearing Journal, 2006
Effects of the LifeTube and LifeTip

Comparison of different coupling systems to open ear response (input = 75 dB SPL)

REUR (Open ear response)

REOR for Life Tip

REOR for standard closed earmold
Effects of the LifeTube and LifeTip

REUR

Open 8mm tip

Closed 8mm tip

Max TM SPL 135
Gain and output with Life fittings

CENTRA Life NAL-NL1 target match 3dB below critical gain
Gain and output with Life fittings

Audiogram for CENTRA Life NAL-NL1 target match 3dB below critical gain
Probe Mic Considerations – Open products

- Prescriptive targets can be used for open products
- Manufacturer first fit may be conservative – for Siemens, default is acclimatization 4. To match targets you must use acclimatization 4.

- The reference microphone should be OFF
  - UNITY – Is OFF when using ICRA signals
  - Fonix – Can turn OFF reference mic
  - Aurical Plus – Version 2.5 allows substitution method
  - Verifit – New software (soon) will allow reference mic to be OFF
  - MedRx – If you use ICRA signals - stored equalization mode is active
Probe Mic Considerations – Open products

- Probe placement can be facilitated by using Tip/Dome
- Venting effects must be accounted for in the software
- Critical gain measures should be used
  - Will minimize feedback tendencies
  - Provide closer match to target
Probe Mic Considerations – Open products

Figure 10. Comparison of REAR and REIG findings for an OC fitting using two different equalization methods with the Verifit probe-mic equipment. Concurrent equalization at test ear is compared with concurrent equalization at contralateral ear. Results are shown for two different gain settings.

Mueller & Ricketts, Hearing Journal, 2006
Probe Mic Considerations – Open products

Figure 11. REAR findings for an OC fitting using concurrent equalization (reference microphone on) versus stored equalization (reference mic off) with the Fonix test equipment.

Mueller & Ricketts, Hearing Journal, 2006
Directional effect

Figure 14. Illustration of the front-and-back REAR measures for a directional OC fitting. Front-to-back difference is displayed on lower portion of chart.

Mueller & Ricketts, Hearing Journal, 2006
Directional effect

CENTRA Life First Fit
front-to-back ratio

0 degrees azimuth

Rear field
Noise Reduction

**Figure 15.** Illustration of the REAR for DNR-on versus DNR-off for an OC product with noise-reduction technology. Difference calculation displayed on lower portion of chart.
Figure 12. Illustration of a poor match to target for an OC fitting for the REIG (pink noise input) and also for the REAR (speech mapping with shaped male voice).

Mueller & Ricketts, Hearing Journal, 2006
Figure 13. Illustration of a good match to target for an OC fitting for the REIG (pink noise input) and also for the REAR (speech mapping with shaped male voice).

Mueller & Ricketts, Hearing Journal, 2006
Figure 7. The average REIG for two commercial OC instruments fitted with standard (open) and occluding (closed) earmold tips using the same tubing.

Mueller & Ricketts, Hearing Journal, 2006
Summary

- Occlusion problems are minimised
- Significant high frequency gain can be achieved (be careful how you use it!)
- Prescriptive targets can be used and match obtained
- Probe-mic measures are critical in these fittings – know your system.
- Directional and noise reduction algorithms are effective but the magnitude of their effect is reduced