

Moda™

Fully featured 10A BTE

MORE CHOICES AND FITTING FLEXIBILITY



Executive Summary

People with mild to moderate high-frequency hearing losses are among the most likely to reject amplification. While they complain of hearing difficulties in some situations, they can function normally in many others. They typically find traditional hearing aids unnatural sounding and cosmetically unappealing. Unitron Hearing's Moda™ BTE is an attractive solution for these individuals who may have resisted a hearing aid in the past. Moda is discreet, very light-weight, and non-occluding so it feels very comfortable and natural to wear. Moda offers a choice of slim tube open fittings or fittings with traditional earmolds to satisfy people with a wide range of hearing losses. Slim tube open fittings offer many advantages including less occlusion, more natural sound quality, reduced auditory fatigue, and increased comfort. However, open fittings, high frequency hearing losses, and the acoustics of the slim tube also present unique challenges. These challenges can be addressed by understanding the impact of an open fitting on hearing aid performance, and the rationale behind the slim tube fitting option for Moda in Unifit™ v5.40.

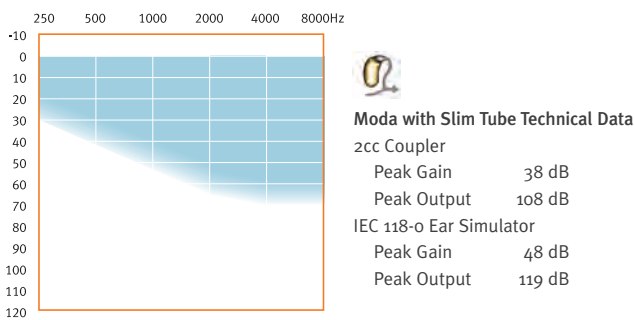
Moda™: Choice in Fitting

Unlike other 10A BTEs, Moda offers the flexibility to choose how you want to fit the product on your clients:

- Slim tube open fitting
- Traditional earmold fitting

Figure 1

Moda with Slim Tube Fitting Guide

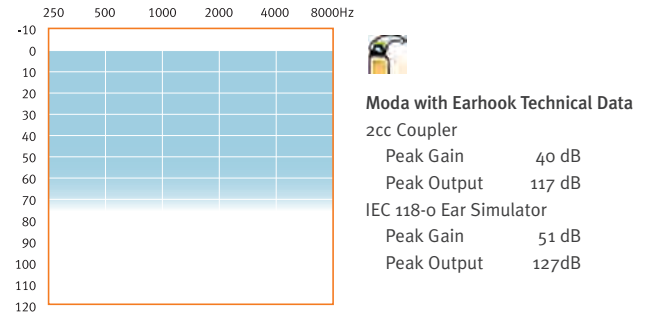


Slim Tube Open Fittings with Moda™

Fitting Moda with the slim tube allows you to provide an open, non-occluding hearing aid fitting, ideal for individuals with sloping, high-frequency hearing losses, where little or no gain is required in the low frequencies. These open fittings significantly reduce occlusion, making the wearer’s own voice sound more natural, and provide a more comfortable, less “amplified”, overall sound quality. Coupling the small, 10A BTE with the inconspicuous slim tube allows you to provide high performance in a cosmetically appealing package. Using the slim tube system to fit Moda also allows you to fit patients in a single appointment. Simply choose the appropriate length of tubes and dome sizes from the slim tube kit, and your clients can leave with properly fitting hearing aids from the first office visit.

Figure 2

Moda with Earhook Fitting Guide



Traditional Earmold Fitting with Moda™

For hearing losses where more low frequency gain and/or more overall gain is required, you can use the small and attractive Moda with a standard earhook and earmold to provide a more 'closed' traditional fitting. Using an earmold allows you to provide more gain without feedback than is possible in an open fitting with the slim tube. Use of an earmold also allows you to fit individuals with hearing loss where more low frequency gain is required, or infants where secure coupling is required.

Successful Open Fittings

A successful open fitting will account for several unique characteristics that are not present in a traditional BTE fitting. When the slim tube option is selected in Unifit™, the software addresses these issues as part of the initial fitting calculations. This ensures optimal performance and sound quality at the very outset of the fitting process. Here are some examples.

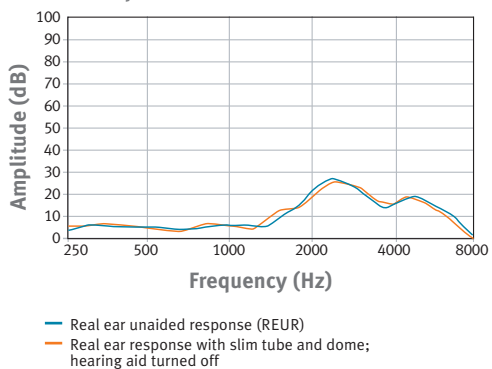
Ear Canal Resonance in Open Fittings

In a traditional hearing aid fitting, the natural resonant characteristics of the external ear canal are

compromised by the insertion of the hearing instrument. In other words, the natural amplification caused by the real ear unaided response (REUR) is significantly reduced. Therefore, initial gain calculations have to compensate for this lost resonance, as well as the measured hearing loss.

When Moda is fit using the slim tube, the ear canal is not occluded by an earmold or hearing aid shell. Rather, the ear canal is typically left unobstructed. As seen in Figure 3, the blue line represents the measured REUR, or natural ear canal resonance for an open ear. The orange line represents the measured ear canal resonance with a properly fitted slim tube and dome in the ear. Notice the similarity of the two measurements. When the curves are so similar, it means that the tube and dome have minimal measurable impact on the natural ear canal resonance.

Figure 3
REUR's: Open Ear vs. Slim Tube

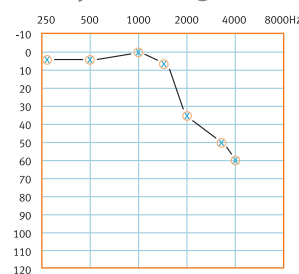


Therefore, while calculating the fitting, there is no need to compensate for the loss or reduction of the REUR.

Figures 4, 5 and 6 illustrate this concept. Figure 4 shows an example of a moderately severe bilateral high frequency hearing loss. Figure 5 illustrates a BTE 2cc target gain curve for 65 dB inputs for the hearing loss shown in figure 4. Remember that part of this target amplification is to make up for the lost natural

amplification of the ear. Figure 6 demonstrates the expected 2cc target gain curve for 65 dB inputs for Moda when using the slim tube to provide an open fitting. When comparing the two figures, you can see there is almost 15 dB less gain prescribed above 2 kHz in the Moda with slim tube fitting.

Figure 4
Example Hearing Loss



A moderately severe bilateral high-frequency hearing loss.

Figure 5
Prescribed Gain - Closed Fitting

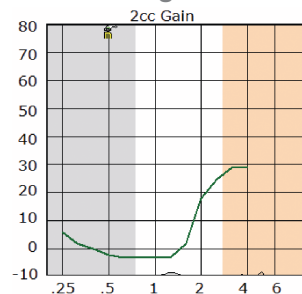


Figure 6
Prescribed Gain - Open Fitting

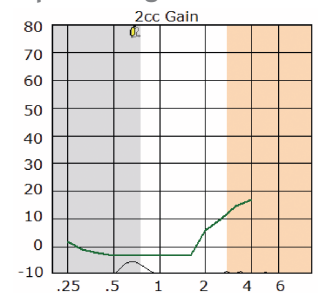


Figure 5 illustrates the gain requirements for the hearing loss shown in figure 4 while figure 6 depicts the gain requirements for the same hearing loss in an open fitting.

Impact of Venting in Open Fittings

By design, an open fitting provides a substantial amount of venting. Essentially all of the amplification below 1500 Hz escapes the ear canal. This provides improved sound quality and more natural listening for individuals with normal hearing in the low frequencies. Increasing the amount of low-frequency output from the hearing aid to compensate for some of the lost gain is possible; however, will not typically improve low

frequency audibility and may cause other issues. Sound quality may be affected or current drain may be increased.

The fitting range for a Moda with slim tube has been adjusted relative to a traditional Moda fitting to account for the effects of venting. The low-frequency fitting range is substantially reduced for slim tube fittings compared to a standard Moda fitting, but the disparity is much smaller in the high-frequency regions. In other words, you will be able to apply more useable gain in the mid and high frequencies of a slim tube fitting than in the lows, making it ideal for sloping high-frequency losses.

Effectiveness of Directional Microphone Systems in Open Fittings

As a fully featured member of the Conversa.NT™ product line, Moda offers an adaptive directional microphone system as a standard feature. Directional microphones are widely recognized to improve speech intelligibility in noise. Adaptive microphone systems provide the additional advantage of being able to track and suppress the loudest off-target noise source.

The effectiveness of the directional microphones is reduced as the amount of venting is increased in the hearing aid fitting. When venting is increased, not only does the low-frequency amplification of the hearing aid escape, but substantial amounts of unprocessed low-frequency energy enters the ear canal. The energy entering the ear canal *naturally* does not receive directional processing and, in fact, reduces the benefit of the directional system in the low frequencies.

As previously discussed, the venting associated with an open fitting significantly reduces the amplification provided by the hearing aid below 1500 Hz. In an open

fitting using a directional microphone system, a similar performance is observed. Table 1 shows directivity index (DI) measurements for Moda as measured on KEMAR at several frequencies.

Table 1

Directivity in Closed vs. Open Fittings

Measured Directivity Index (DI)						
Test Frequency (Hz)	496	1008	1504	2000	4000	6000
Closed earmold	4.1	6.0	6.8	6.3	6.1	5.4
Slim tube open fitting	-2.8	5.3	5.2	6.9	7.7	6.4

These measurements show that the directional performance measured on the ear is reduced through 1500 Hz as expected. However, DI measurements at 2, 4 and 6 kHz indicate directional benefit is maintained and even slightly enhanced in the higher frequency regions in an open fitting. This may be because the natural directivity of the ear (pinna and concha effects) is maintained when fitting Moda using the slim tube. In a traditional fitting, this natural directivity of the ear is typically lost and we must rely on the hearing aid to provide directionality.

Feedback and Open Fittings

Potential for acoustic feedback is a concern in any hearing aid fitting, regardless of shell style. The goal is usually to provide as much gain as possible without introducing uncomfortable or embarrassing feedback for the wearer. As part of the Conversa.NT family, Moda uses the realtime feedback canceller to address fit related feedback as well as feedback in everyday listening situations, to help ensure the focus remains on conversation.

Because of the open nature of the slim tube fittings, a

significant feedback pathway is created and there is, therefore, a greater potential for feedback to occur at a much lower gain threshold than with more closed fittings. Although the system may not be unstable enough to generate the audible “squeal” we associate with feedback, instances of sub-oscillatory (brief, low level) feedback are more common. This can translate into complaints such as the occasional beep or 'chirp' from the hearing aid, as well as complaints not typically associated with feedback, such as an “echo” sound quality.

To address this possibility, running the feedback optimization test is strongly recommended during the fitting of a Moda hearing aid to evaluate the maximum stable gain that can be provided in the fitting. The feedback optimization test can be found on the **Feedback Management** screen in Unifit.

Acoustics of the Slim Tube

The slim tube provides an inconspicuous, cosmetically appealing option for fitting Moda. Because of the physical properties of the tube, there is an impact on the acoustics that must be addressed as part of the hearing aid fitting.

The slim tube has a sound bore with a significantly smaller internal diameter than traditional earmold tubing. The sound bore of the slim tube is also smaller than the receiver mounting on the hearing aid. The smaller diameter creates an enormous increase in impedance relative to a standard #13 tubing. The net result of this impedance change is that the frequency response of the hearing aid is altered. Most notably, there is a significant roll-off or reduction in high-frequency amplification with the slim tube.

Figure 7
Earhook Frequency Response

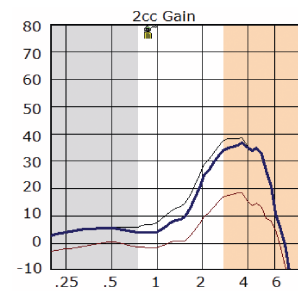


Figure 8
Slim Tube Frequency Response

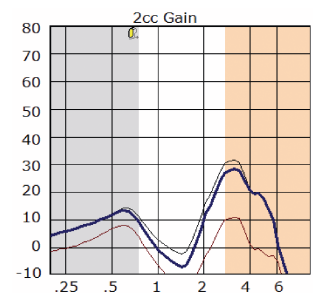


Figure 7 and 8 illustrate a reduction of 10-15 dB of gain above 1.5 kHz by replacing the earhook with a slim tube.

Figure 7 illustrates the frequency response of a Moda BTE coupled to a standard filtered earhook. Figure 8 represents what would happen to the frequency response if the earhook were removed and replaced with a slim tube. By simply changing the acoustic coupling system, there is a reduction of 10-15 dB of gain above 1.5 kHz. Additionally, there is an added resonance in the lower frequencies between 500 and 750 Hz. These changes to the frequency response must be properly compensated for to ensure an appropriate level of amplification is provided. The **Slim Tube** option on the **Quick Fit** screen for Moda makes these corrections automatically with a single click of the mouse.

Fitting High-Frequency Hearing Losses

Fitting hearing aids on individuals with high-frequency hearing loss can be challenging. Two clients with similar audiograms can be fit with comparable levels of amplification and yet report very different listening experiences. One client can report good intelligibility

with pleasant sound quality, while the other client may describe distortion, excessive “tinniness” or a metallic sound quality. The complaints may be attributable to one client having a region with no inner or outer hair cell function in his/her cochlea (i.e. cochlear dead spot). If we simply apply gain to compensate for the degree of hearing loss according to a traditional fitting rule, and a cochlear dead spot is present, the client reporting poor sound quality may be experiencing what is referred to as 'off-frequency hearing'. This occurs when high intensity signals are applied to a region with no cochlear function. While the dead region remains unaffected, the signal level is sufficiently high to result in excitation of inner hair cells in an adjacent frequency region of the cochlea.

High-Frequency Hearing Loss Correction Tool 

To deal with some of these challenges in fitting high-frequency losses, the high-frequency hearing loss correction tool has been introduced in Unifit v5.40 for fitting Conversa.NT. When applied to a fitting, the high-frequency hearing loss correction reduces the amount of amplification prescribed above 2500 Hz, and provides a modest increase to the gain calculation between 500 and 2000 Hz. The goal of this correction is to reduce the likelihood of over-stimulation in the high frequencies and instead focus the amplification on the transition area of the hearing loss, where the audiometric thresholds slope from normal hearing sensitivity towards the frequencies where the hearing loss is most severe.

Figures 9, 10 and 11 illustrate the effects of the high-frequency hearing loss correction.

Figure 9
Example Hearing Loss

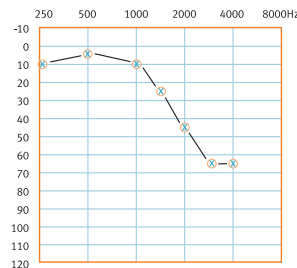


Figure 9 shows a moderately severe high-frequency hearing loss.

Figure 10
Default Quick Fit

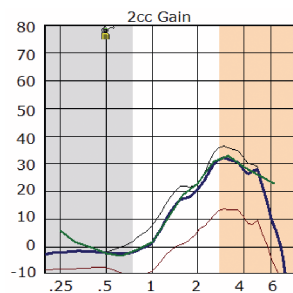


Figure 10 shows the 2cc coupler target gain and hearing aid response for a Conversa.NT directional BTE fit to the audiogram shown in Figure 9.

Figure 11
Quick Fit with High-Frequency Hearing Loss Correction

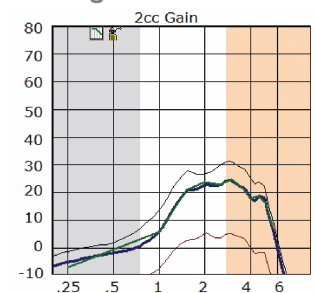


Figure 11 shows the 2cc coupler target gain and hearing aid response for the same hearing aid fit to the same audiogram, but this time using the high-frequency hearing loss correction.

The high-frequency hearing loss correction tool provides a simple, subjective method to evaluate the benefit of additional high-frequency gain for clients with precipitous high-frequency hearing loss.

Fitting Conversa.NT with Earmold: For all Conversa.NT products except for Moda with slim tube, Unifit will not apply the high frequency correction to the initial Quick Fit calculation. However, if the client reports any sound quality issues such as harshness or distortion, click the high frequency hearing loss icon to activate the high frequency hearing loss correction, then re-Quick Fit the hearing aids. The undo/redo buttons on the toolbar can then be used to allow the client to make a subjective comparison between the two settings.

Fitting Conversa.NT Moda with Slim Tube: When the **Slim Tube** option is selected on the **Quick Fit** screen, Unifit will automatically apply the high frequency hearing loss correction to the fitting. The combination of these two corrections has been found to provide optimal sound quality for open fittings. These corrections compensate for the effect of the slim tube on the frequency response of the hearing aid as well as the fact that the natural ear canal resonance is not lost when using the slim tube.

Summary

Moda™, styled for Conversa.NT™, is the ultra-small, fully featured 10A BTE that offers a stylish, discreet and quick fit to satisfy more hearing losses. Moda offers a small profile, coupled with inconspicuous slim tube open fittings for the most cosmetically appealing solution to style-conscious clients. Moda was designed to lessen the barriers and stigma typically associated

with wearing hearing instruments, and improve customer acceptance, especially for new wearers. Clients like the Moda styling because it is discreet, light-weight, and non-occluding so it feels very comfortable and natural. By becoming familiar with some of the considerations of fitting open, slim tube hearing instruments, and how to accommodate high frequency hearing losses effectively, hearing healthcare professionals can fit more clients with a wider range of hearing losses with a stylish, full performance BTE.

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