

Speech Mapping

Benefits of Using Speech Mapping - Article written by Michael Poe

Straight Talk on Live Speech Mapping

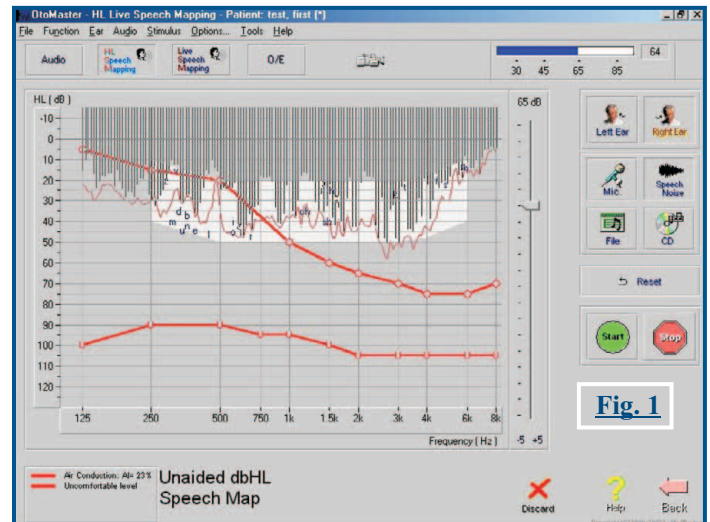
The primary objective to satisfy in hearing rehabilitation is our patients' desire to hear and understand "speech". This article presents the outcome of using a recent innovative approach, Live Speech Mapping, to achieve this objective and "get it right the first time". It only makes sense to use real speech as the signal of choice for successful hearing instrument fittings. In Live Speech Mapping, we have made speech "King". Live Speech Mapping uses the voices of the clinician or patient's significant other for real ear measurements. The specific design of Live Speech Mapping taps into a previously unmet need in hearing instrument fitting, which was to make standard clinical real ear measurements meaningful and more enjoyable for patients and clinicians. Using speech as the input signal and displaying data so that it could be intuitively understood satisfied this need. The prior use of tonal or noise stimuli in real ear measurements gave the patient no appreciation of the significance of these tests and the clinician little data regarding the audibility of real speech. Speech is both a familiar and interesting signal. It is essential to determine how much speech is audible to achieve effective hearing rehabilitation. While it is true that audibility does not guarantee understanding, we do guarantee that an inaudible sound will not be understood! Live Speech Mapping allows us to place "real speech", with its continuously fluctuating amplitude and spectral characteristics, into the patient's preferred listening range (typically midway between threshold and UCL). The target for the LSM REAR is not a single value at octave or 1/2 octave frequencies, as suggested by the numerous fitting rules. Rather, the target is a dynamic area represented by characteristics of the patient's residual dynamic range. The Live Speech Map is presented in an intuitively easily understood graphic, empowering the patient with a clear "visual" sense of the hearing loss and aided benefits as they relate to actual speech. Patients and their families can better "see" the hearing loss, aided benefits and limitations when watching Live Speech Mapping. In this case, "Seeing is believing". Live Speech Mapping also provides the clinician with a quick and precise measuring instrument to achieve successful fittings.

How Live Speech Mapping is performed

Live Speech Mapping is a real ear measurement and provides a dynamic presentation of how much speech is reaching the patient's eardrum. The resulting data is presented on either a dBHL or dB SPL screen. Each screen displays the patient's audiogram and long term speech spectrum. While the measurement is in progress, a continuously updating peak curve from 125Hz to 8kHz is displayed in real time.

Using Live Speech Mapping to Demonstrate the Hearing Loss

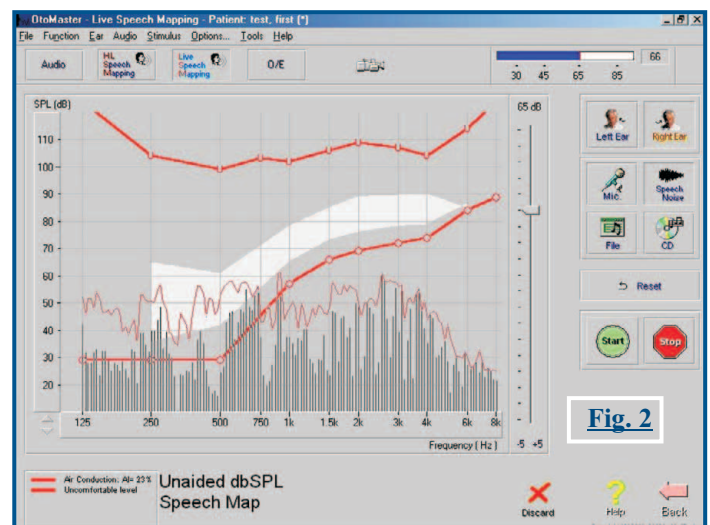
Unaided measurements are performed with the probe microphone in the ear canal within 6mm of the eardrum (**Fig.1**). With the patient seated facing the clinician at one meter distance, the clinician reads the "Rainbow Passage" at a normal vocal effort for a quiet room. The clinician monitors the input level using a displayed VU meter reporting the input level at the probe reference microphone situated just outside the ear canal. The "Rainbow Passage" provides an ideal sample of all the speech sounds in American English speech, as they would appear in normal conversation. The real ear measurement curve is stored and



plotted on either a dBHL or dB SPL display. In the dBHL presentation, the screen displays the patient's hearing thresholds, UCLs and long term speech spectrum.

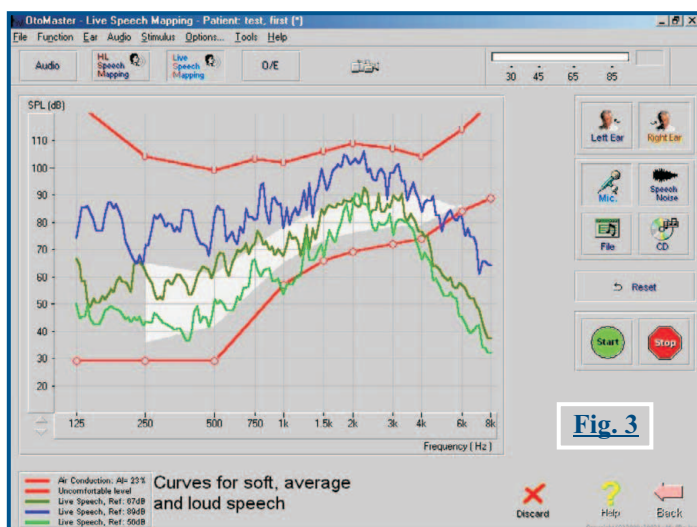
In the dB SPL presentation, the patient's hearing thresholds, UCLs and a modified aided speech spectrum are on the display, representing the patient's residual and preferred listening range (**Fig. 2**). The speech spectrum is modified to represent the portion of the reduced dynamic range that the long term speech spectrum would occupy to achieve loudness normalization.

In each display mode, both the clinician and patient can "see" what frequencies of speech are audible and those that are inaudible. We recommend the patient's significant other also read the "Rainbow Passage" to generate data on the audibility of a meaningful other.



The unaided Live Speech Map is intuitively easy to understand and generates a better understanding of the patient's hearing loss. This makes it easier for the patient and family to both accept and commit to the hearing rehabilitative process.

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Live Speech Mapping and Hearing Instrument Fitting

Aided real ear Live Speech Mapping measurements are performed in the same manner as for unaided measures, as described above (Fig. 3). This time, the hearing instrument is also insitu and the clinician has the luxury of real time, simultaneous programming of the instrument since the Live Speech Map is presented "on top" of NOAH programming modules. Clinicians aim to have the aided curve, for comfort level input, "peak" at the top of the aided speech spectrum or midway between threshold and UCL. Since the outcome of programming adjustments for gain are presented in real time, the clinician can quickly achieve a precise fitting. Features of smart hearing aid technology can be easily tested and demonstrated with Live Speech Mapping. The process of ensuring WDRC hearing instruments are performing correctly is both quick and easy. WDRC circuits are designed to provide more gain for soft inputs and less gain for loud inputs. Live Speech Mapping allows the clinician to monitor the aided output for normal, soft and loud speech. Varying the distance of the person speaking relative to the patient or changing vocal effort easily changes the input level. Clinicians aim to have as much of soft speech audible as possible, comfort speech midway between threshold and UCL and ensure loud speech remains tolerable.

Live Speech Mapping as a counseling tool

Patients and their families' benefit greatly from the knowledge they gain of the hearing loss, the improvement with hearing aids and the remaining limitations to hearing performance. The Live Speech Map provides an excellent "view" of the patient's hearing and greatly aids in setting realistic expectations for rehabilitation.

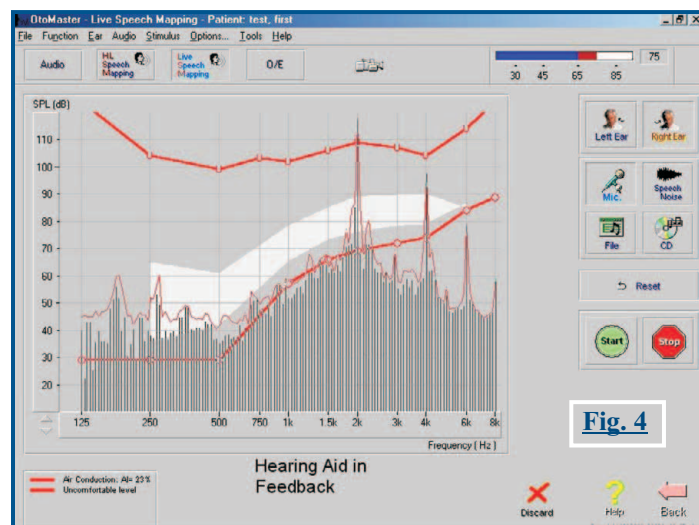
Further uses for Live Speech Mapping

Hearing Aid fittings are often plagued by feedback problems (Fig. 4). Live Speech Mapping can pinpoint the exact frequency of feedback and often displays feedback before it is even audible to the clinician. Some hearing instruments are sophisticated enough to allow the clinician to adjust the gain at discrete frequencies, thereby managing the feedback without compromising required gain at surrounding frequencies.

Another important use of Live Speech Mapping is to demonstrate directional microphone technology. A suggested method for directional microphone measures includes adding Live Speech Mapping measures from the side and/or rear to the 0 degree horizontal azimuth standard measure. In each position toggle between the omni directional and directional microphone

configuration. The patient can hear the difference as well as see the frequency-dependent response reductions.

Live Speech Mapping is also useful in demonstrating multiple memories, volume control adjustments, multichannel processing and earmold modifications. Since Live Speech Mapping allows for quick and precise hearing aid fittings, clinicians are left with time to further qualify fittings with aided speech testing and for patient counseling.



Where's the proof? Results in the clinic.

Live Speech Mapping was implemented in clinics in early 1999. In a published article in the Hearing Journal, Professor Cunningham and colleagues, of the University of Louisville School of Medicine, reported the specific patient and clinical benefits of using Live Speech Mapping to fit hearing instruments. Over an 18month period, using Live Speech Mapping reduced the number of post-fitting follow up visits and as a result, lowered practice costs. The clinic noted a "48% reduction in total number of follow-up visits and a 36% reduction in mean number of visits per patient when Live Speech Mapping was applied".

The specific patient and clinic benefits cited in the article include: Real ear data were made meaningful to the patient and significant other due to the use of visually appealing, color graphics for intuitively understood results. This allowed the clinicians to provide a more convincing presentation of the hearing loss and how finely tuned the hearing instrument was to their hearing loss. The patient, significant other and clinician had more confidence in the fitting process.

Because the hearing aid required little follow up "tweaking", follow-up visits focused more on non-technical, patient centered rehabilitation activities that are more likely to improve benefit, satisfaction and product retention.

In Conclusion

The practice of using Live Speech Mapping saves valuable clinical time. This time can be devoted to new hearing aid patients, counseling and aural rehabilitation programs for patients and their families, and other clinical/administrative functions. Live Speech Mapping approach also lowers the patient's costs by avoiding unnecessary follow up appointments and travel costs, thereby promoting greater patient satisfaction. Live Speech Mapping is an innovation in the hearing aid fitting process that helps audiologists and their patients by "getting it right the first time".