Objective measurement of speech audibility - value to the client and clinic

The Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study, being carried out through the National Acoustic Laboratories (NAL) and HEARing Cooperative Research Centre (CRC), has been running since 2007.

Evidence collected from the first five years of the study has clearly identified that earlier diagnosis, coupled with earlier fitting of technology (under 12 months of age), is a critical factor in achieving the best outcomes in language and social development. Parallel studies in the elderly have identified a similar need for timely assessment of hearing and communication. Appropriate intervention again in this group has played an important role in social integration; this can be a challenging task in particular for patients in the early stages of dementia.

Given these findings, when a hearing impaired adult, their carer or the parents of a hearing-impaired child decide to proceed with a hearing device, it is important to provide appropriate amplification as quickly as possible. For clients unable to provide behavioural responses, fine tuning a hearing device has traditionally been time consuming, even when reliable thresholds can be obtained using evoked potentials (such as Auditory Brainstem Responses [ABR] or Auditory Stead State Responses).

To address these issues, Australian Hearing (AH) introduced HEARLab to several of its clinics and uses it to measure Cortical Auditory Evoked Potentials (CAEPs) in both adults with significant physical or cognitive disability and infants too young to give reliable behavioural responses. The clinics have found a number of benefits to using this technique, one of the major ones being timely and appropriate amplification for these complex client groups to obtain a reliable objective measure of speech audibility. This has enabled fine tuning of client devices within weeks of fitting, a task that has previously take months or even years. In addition, the greater certainty provided by the HEARLab hearing evaluation has reduced the need for multiple test appointments, saving time for both the clinic and the families/carers (who are often involved in a number of medical appointments). There has also been an unexpected benefit that families/carers themselves seem to have greater confidence in HEARLab test results, enabling them to really focus on providing a rich speech and language environment for the client.

Another benefit of the objective information provided by HEARLab has been the streamlining of infant cochlear implant referrals within AH clinics. It has facilitated the identification of individuals who have limited benefit from conventional amplification, speeding up candidacy evaluation and ensuring that implantation can occur within the critical time frame.

HEARLab was developed by NAL and the HEARing CRC in response to these needs and has been on the market for almost two years. The equipment runs via a laptop computer and operates as a single piece of hardware in which software components such as the CAEP Assessment module can be installed. New HEARLab modules currently under development and testing include Auditory Brainstem Response (ABR) testing and an Automatic Cortical Audiometer. The CRC's HEARnet Learning (https://www.hearnetlearning.org.au/) also has ASA accredited training courses available on the theory and practice of using HEARLab. ■

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CASE STUDY: MARY

Mary's hearing loss was detected through newborn hearing screening.

At six weeks of age Mary presented for hearing aid fitting - her hearing loss was severe (no responses recorded in either ear at 95dBnHL for all frequencies using ABR) and her threshold estimation was problematic. The audiologist assumed the ABR threshold was 5dB worse than the maximum presentation level, and applied appropriate conversion to estimate behavioural thresholds. ***Mary's hearing aids were set to match prescriptive targets for gain and MPO that had been derived using the estimated audiogram.***

Several weeks later, aided CAEPs were assessed and recorded no significant response to low, mid or high frequency speech stimuli, at average (65dBSPL) or loud (75dBSPL) conversational levels. Given these findings, Mary's audiogram was re-estimated assuming low frequency ABR thresholds 5dB poorer and high frequency thresholds 10dB poorer than first predicted. ***Hearing aids were appropriately adjusted to match the new prescription targets.***

At three months old, aided CAEPs were assessed again and continued to show no significant responses to any of the speech stimuli at input levels of 65 or 75dBSPL. ***Mary was referred for cochlear implantation candidacy assessment, and received bilateral implants at five months of age.***

Mary's parents later emailed their audiologist saying: "Thank you so much for the information you gave us on the previous testing as it helped us with our decision to proceed with the implants."