CHAPTER

17 Conclusion and Case Studies

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'Children require the highest standard of care, where efficiency cannot compromise precision.'

~World Health Organisation, 2025

Summary

This chapter brings together core insights presented throughout the book by reinforcing the importance of early, individualised and contextually sensitive intervention while acknowledging the real-world complexities faced by practitioners. Drawing on three diverse case studies, this chapter illustrates how assessment and management strategies are applied in practice, demonstrating the adaptability and critical thinking required in everyday clinical settings. Ultimately, this chapter encourages readers to integrate evidence-based knowledge with reflective practice to deliver effective, compassionate and contextually appropriate hearing care to the paediatric population.

Learning objectives

From this chapter, the reader will be able to:

1. Understand integrated, person- and family-centred approaches to paediatric audiological care.
2. Describe contextual factors influencing clinical decision-making, such as family dynamics and resource availability and how these shape individualised care.
3. Practically apply varied assessment and management protocols across diverse paediatric case scenarios.

Overview

Integrated, person-centred and evidence-based approaches are advocated throughout this book to ensure accessible and equitable hearing services for the paediatric population, especially in diverse settings. The Treasures of Wisdom provided by the clinically experienced authors offer practical strategies informed by real-world experiences to support effective identification and management of paediatric hearing loss (HL) across diverse populations.

This book provides Hearing Healthcare Professionals (HHPs) with insights into the multi-faceted nature of paediatric HL, its varied causes, evolving prevalence and developmental implications (Chapter 2). A deep dive into the anatomical and physiological underpinnings of the auditory and vestibular systems further reinforces the importance of clinical precision (Chapter 3). These insights are linked to broader programmatic efforts, such as hearing screening protocols (Chapter 4) and behavioural (Chapter 5), electrophysiological (Chapter 6) and vestibular assessment (Chapter 7). Auditory Processing Disorder (APD), because it shares certain symptoms and characteristics with other neurodevelopmental conditions, presents a distinct diagnostic and therapeutic challenge (Chapter 8). These assessment findings provide a quantifiable foundation for diagnostic and rehabilitative decisions and should be approached with both technical expertise and ethical responsibility.

Accurate identification requires a multidisciplinary approach involving collaboration among audiologists, speech-language therapists, ear-, nose- and throat (ENT) specialists, psychologists and educators. The importance of such teamwork is reinforced throughout the book, highlighting how structured, solution-focused interdisciplinary collaboration (Chapter 14) leads to more effective intervention outcomes. This collaborative ethos extends to the management of conductive hearing loss (CHL), where surgical intervention may be required (Chapter 9). Seamless referral systems and strong interprofessional relationships, especially between audiologists and ENT specialists, are critical to ensuring timely, coordinated and effective care for children requiring medical or surgical treatment.

It is of utmost importance that HHPs prioritise early, individualised and family-centred intervention in managing the identified hearing and/or vestibular pathology. Hearing aid fitting (HAF) is not a one-time event but a dynamic process requiring precise verification, routine monitoring and close collaboration with families (Chapter 10). When hearing aids (HAs) are insufficient to provide quality auditory access, timely referral for implantable devices

becomes crucial (Chapter 11). These interventions, when implemented early and supported through comprehensive (re)habilitation, lead to optimal auditory brain development and enhance long-term communication, and educational and social outcomes for the paediatric population.

The single most important intervention decision after the diagnosis of a child's HL is the family's choice of language — the language of their heart. This decision has lifelong implications, influencing not only how a child communicates but also their educational access, social identity and developmental trajectory. The Auditory Verbal Therapy (AVT) approach is one possible pathway. This approach acknowledges caregivers as the primary agents of change in their child's life and involves coaching by the HHP (Chapter 12). Building on these principles, other communication options, such as Cued Speech and Signed Language, as well as the broader educational landscape for children with HL, are discussed (Chapter 13). There are multiple schooling options, such as mainstream inclusion, facilitation or special education. However, across all educational settings, the consistent thread is the critical role of family commitment and support.

The holistic nature of paediatric audiological care is driven by collaboration, empathy and innovation in order to ensure better outcomes. Establishing structured communication systems, regular meetings and shared protocols improve clinical efficiency, and also place the child and family at the heart of decision-making (Chapter 14). This theme is deepened in Chapter 15, which explores Person and Family-Centred Care (P/FCC) as a guiding philosophy that recognises the lived experiences, values and voices of both children and their families.

Acknowledging the diverse nature and availability of resources across the globe, Chapter 16 offers guidelines on the use of telehealth to overcome geographical and resource-related barriers, supporting equitable, high-quality care that aligns with both P/FCC principles and the growing demand for innovative, flexible service delivery. By integrating theoretical foundations with applied clinical practice, the book aims to equip readers with the tools necessary for effective assessment and intervention.

Case Studies

Below are three case studies that demonstrate the practical application of protocols discussed throughout the book, reinforcing the importance of adaptability, critical thinking and holistic care in paediatric audiology, specifically in contextually diverse settings.

Case study 1

Area: Ndluma rural settlement

Region: Semi-arid interior, East Africa

Background history

Ndluma is a small, isolated settlement located in the semi-arid interior of East Africa. Most families rely on subsistence farming and small-scale livestock rearing, and health services are limited to a single primary healthcare clinic staffed by two nurses, with a general practitioner visiting once a fortnight. This clinic is vital for treating common illnesses, supporting maternal health and delivering childhood vaccinations. However, there are no ENT or audiology services available locally, and the nearest specialist district hospital is more than 200 kilometres away, accessible only by rough, unpaved roads. Travelling there requires hiring costly shared transport, a burden few families can afford, especially during the rainy season when flooding can block the route entirely.

Teachers at the local school have long noticed that several children struggle to follow lessons, often sitting quietly at the back of the classroom or depending on peers to repeat instructions. Parents tend to attribute these behaviours to shyness, distraction or lack of effort, rarely considering that HL might be the cause. With no formal hearing screening ever carried out in the village, most children have never been assessed by an audiologist or hearing care professional. Community leaders have voiced growing concern about the long-term effects of untreated healthcare issues on children's learning and development, but practical solutions have yet to be put in place.

Despite geographical isolation, the community does have access to mobile phone coverage, creating an opportunity for the use of technology to deliver services that would otherwise be out of reach.

Assessment considerations: Two-stage screening approach

To respond to the lack of hearing care, a nurse-led, two-stage mHealth screening process is proposed for Ndluma. As outlined in Chapter 4, the first stage will involve pure-tone air-conduction screening, conducted by local nurses using mHealth tools such as hearScreen®. This test will be carried out in the local school, to identify educationally significant HL (that is, > 20 dB HL) and avoid referral rates that might overwhelm limited health resources. Children who do not pass the mHealth hearing screening at school will move on to the second stage of screening. The second stage will involve functional assessment using speech-in-noise hearing screening via the hear WHO (or equivalent) digits-in-noise test. By combining pure-tone threshold screening with speech-in-noise testing, the mHealth screening programme can more accurately identify children with meaningful listening difficulties, while reducing false-positive results and unnecessary burden to other levels in the healthcare system.

Both screening stages are to be conducted in quiet spaces within the school or healthcare clinic, with the built-in noise monitoring features of the mHealth apps ensuring maximum permissible ambient noise levels are respected. Children will be given a short practice trial to familiarise them with the task before testing begins. All results will be carefully recorded by means of structured forms and uploaded to a secure database, allowing audiologists to monitor outcomes remotely using asynchronous technology (tha is, store-and-forward). Based on specialists' reviews, audiologists may recommend repeating a hearing screening (for example, due to a noisy environment) before referring children to the outreach hearing clinics.

Training and quality control

The success of the programme depends on the skills of the nurses who will be conducting the screening. They will undergo structured in-person training by audiologists, focusing on test administration, troubleshooting, rescreening techniques and referral decision making. Ongoing supervision (either in person or remotely, where possible) will provide opportunities for refresher training and case discussion, ensuring consistent practice. Quality assurance

will be a key feature of the programme: nurses will carry out daily listening checks on their equipment, and calibration will be conducted in line with manufacturer recommendations and referral rates will be regularly monitored to maintain accuracy.

Follow-up and referral

The implementation of a hearing screening programme is not sufficient unless clear and practical referral pathways are in place. For Ndluma, a hybrid model of follow-up is proposed. Children who do not pass either stage of screening should be seen when ENT and audiology specialists from the district hospital conduct scheduled outreach visits to the settlement (for example, bimonthly or quarterly). These outreach clinics will provide diagnostic audiometry, tympanometry, video-otoscopy review and initial HAFs for children with permanent HL, enabling families to access these specialised services locally without bearing the heavy financial and logistical burden of travel. For children with more complex needs, referral to the district hospital may still be necessary for diagnostic testing and HAF.

With the availability of mobile networks and the expansion of internet coverage, teleaudiology will continue to support families and nurses after diagnosis. This support may include asynchronous review of test results, synchronous remote HA programming and troubleshooting for children with HL, family counselling and ongoing capacity building conducted between outreach visits. In this way, holistic hearing care will be continuous and responsive, even when hearing care specialists are not physically present in the community.

Intervention considerations

Children identified with HL may have access to rehabilitation through a combination of in-person and telehealth support, with decisions about the nature of this support made on a case-by-case basis through collaboration with the families. Drawing from Chapter 16, HAs may be fitted during outreach clinics, with adjustments and verification carried out under the guidance of audiologists. Telehealth may then be used to provide ongoing auditory training, parent/carer coaching and communication intervention, embedding rehabilitation into the family's daily routines. Teachers will be engaged as key partners, implementing classroom strategies such as preferential seating and noise reduction to optimise listening environments. Children requiring medical or surgical management will be referred to the district

hospital for ENT services, with follow-up coordinated through the hybrid outreach and hospital pathway.

Case study 2

Name: J.S.

Age: 7 years 2 months

Background history

J.S. is a 7-year-old boy who presents with a history of left chronic otitis media (COM) with occasional discharge from the left ear. There are no other risk factors for HL, and he passed newborn hearing screening bilaterally (OAE method). He was fitted with a left behind-the-ear (BTE) HA when he was five years old, until he was old enough for tympanoplasty (TPL) surgery. He is a good HA user and is doing fairly well at school, but he reports that he struggles to hear in noisy environments, and is sometimes not sure where a sound is coming from. His teacher reports some concentration problems at school. Furthermore, his physical education (PE) teacher reports that J.S. is clumsy, and seems to exhibit some balance problems during PE class. His pre-operative audiogram is presented in Figure 17.1 below. He presents with normal hearing in the right ear, and moderate CHL in the left ear (standard pure tone audiometry was used; air-conduction thresholds were obtained using insert-earphones; masked bone-conduction thresholds were obtained in the left ear). A small central, dry perforation of the left tympanic membrane was visible during otoscopic examination. Pure tone average (PTA) correlated well with Speech Recognition Thresholds (SRT) in both ears. His hearing has been stable over the last year. The recommendation after completing his pre-operative audiogram was for him to see an ENT specialist to determine the surgical plan, and it was recommended that he return to audiology for a post-operative audiogram to determine ongoing need for amplification intervention.

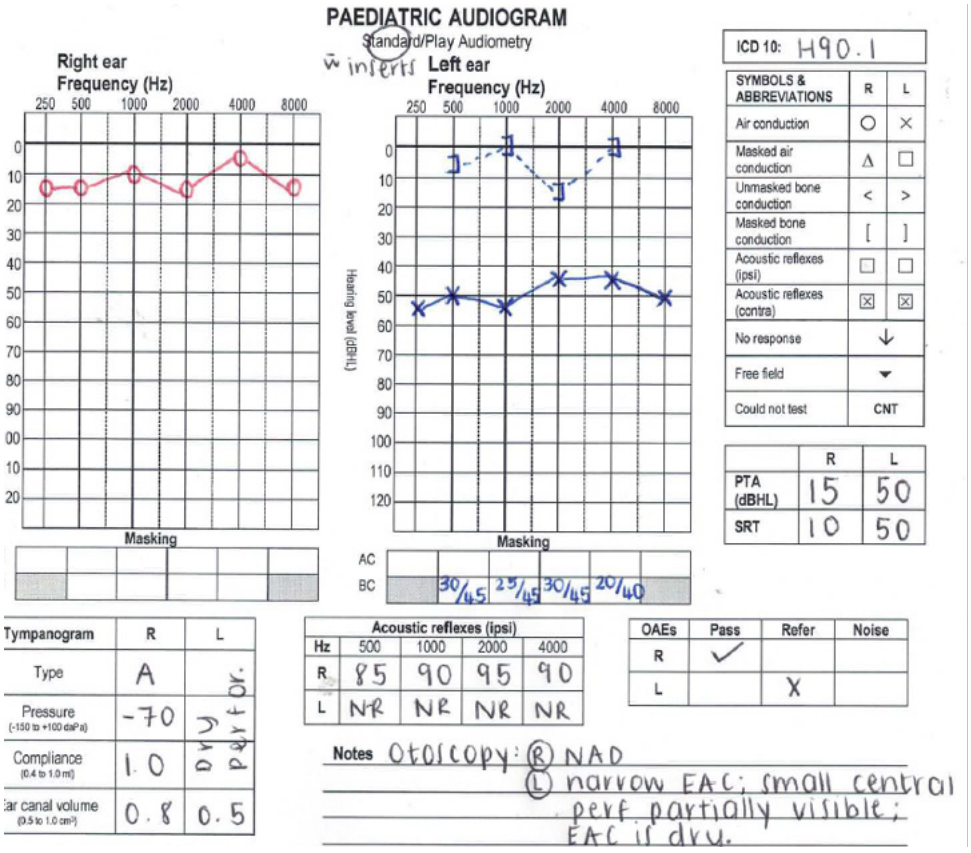


Figure 17.1: Pre-operative audiogram for J.S.

J.S. returned for a post-operative audiogram after TPL surgery (Figure 17.2). He reports that he still sometimes uses his left BTE HA, but it is now too loud. He presents with a residual perforation of the left tympanic membrane (graft did not take) and had drainage from the left ear for two months post-surgery. His left ear was dry on the day of his post-operative audiogram. Post-operatively, his audiological results indicate normal hearing for the right ear, and mild CHL for the left ear (standard pure tone audiometry was used; air-conduction thresholds were obtained using insert-earphones; masked bone-conduction thresholds were obtained in the left ear). PTA correlated well with SRT in both ears. The recommendation after completing his post-operative audiogram was for him to see an ENT specialist to determine further surgical management options, as well as to re-programme and verify his left BTE HA based on his post-operative results. He was also referred for a vestibular assessment due to his PE teacher's concerns regarding balance.

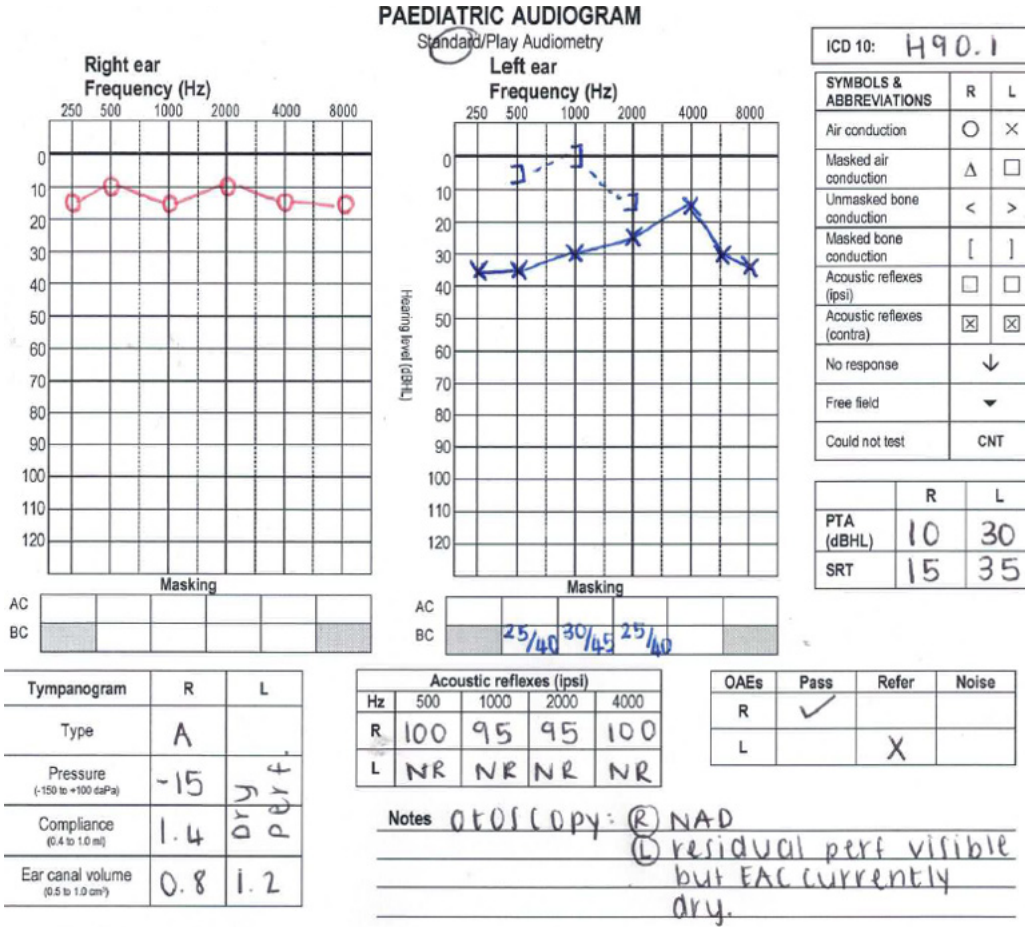


Figure 17.2: Post-operative audiogram for J.S.

Surgical considerations

As outlined in Chapter 9, TPL is a common surgical option for children with COM and tympanic membrane perforation, with the goal of eradicating disease and improving hearing. Age at the time of surgery is an important consideration, as outcomes tend to be more favourable in older children due to better eustachian tube (ET) function, reduced frequency of upper respiratory tract infections and improved ability to comply with post-operative care. For this reason, many surgeons recommend delaying surgery until approximately six to eight years of age, unless the perforation is causing recurrent infections or significant HL that cannot be effectively managed with amplification. In J.S.'s case, fitting a HA at age five provided access to sound until he was considered ready for TPL.

Despite advances in surgical technique, graft failure remains a well-documented outcome in paediatric TPL, with reported success rates ranging from 70–90% (Bayram et al. 2020). Residual perforations may occur due to a variety of factors, including persistent ET dysfunction, recurrent otorrhea, infection during the healing phase, poor vascular supply to the graft site or challenges with surgical placement and stabilisation of the graft (Bayram et al. 2020). Children are prone to fluctuating middle-ear pathology that may compromise long-term graft stability.

Repeat TPL may be considered when residual perforations are associated with persistent HL, recurrent otorrhea or impact on quality of life. Criteria for revision surgery typically include the presence of a dry ear at the time of evaluation, absence of active infection, adequate middle-ear mucosal health and realistic expectations regarding the likelihood of graft uptake. In cases where the contralateral ear demonstrates normal hearing (as in J.S.'s case) careful consideration is given to the functional impact of unilateral loss versus the risks and benefits of revision surgery.

Amplification considerations

For children with unilateral CHL managed with TPL, HAs often play a central role in providing consistent auditory access both pre- and post-operatively. In J.S.'s case, his left BTE HA required re-programming and verification after surgery, as his residual conductive loss improved from moderate to mild. A common issue in such scenarios is that an HA previously fit for greater levels of loss may sound uncomfortably loud after surgical improvement, necessitating reprogramming to ensure audibility without over-amplification. Drawing from Chapter 10, real-ear verification (RECD-based or probe-microphone measures) is essential to validate appropriate output and ensure comfort, particularly in paediatric fittings.

Verification of the HAF is particularly critical for J.S., due to the conductive component introduced by the tympanic membrane perforation. The increased ear canal volume caused by the perforation alters resonance characteristics and significantly affects sound pressure levels (SPLs) in the ear canal. While children typically present with smaller ear canal volumes, resulting in elevated SPL and positive real-ear-to-coupler differences (RECD), the opposite is observed here. For J.S., the larger canal volume is expected to yield lower ear canal SPL, resulting in negative RECD values. This, in turn, necessitates more gain to achieve

audibility targets. Use of actual, individually measured RECD values is therefore mandatory, as reliance on age-appropriate averages would lead to significant fitting errors.

During the fitting, the HA should be programmed using either the NAL-NL2 prescription or the DSL prescription. Studies have indicated that children often prefer NAL-NL2 in background noise and DSL when it is quiet (Pittman and Stewart 2023). Feedback from the teacher, using the PEACH questionnaire (Ching and Hill 2007; see Chapter 10), should provide valuable information about the child's participation and communication in background noise with the HA, and contribute to evaluating the validity of the chosen prescription. As J.S. is now seven years old, Real Ear Measurements (REM) may be attempted if he can sit quietly with the probe in place for an extended verification session. The recommended alternative is programming in the HIT box and using measured values to calculate the RECD. These RECD measurements should be repeated regularly to account for ongoing ear canal growth and possible changes in middle-ear status.

Special consideration must also be given to the presence of a tympanic membrane perforation. While a dry perforation does not automatically contraindicate amplification, it does raise concerns regarding the risk of infection and the potential for fluctuating thresholds if middle-ear status changes. Clinicians should counsel families on the importance of monitoring for otorrhea, as ear canal coupling of a BTE earmold may exacerbate drainage if infection recurs. When drainage is active, amplification should be discontinued until the ear is medically managed, both to protect the device and prevent discomfort.

As hearing thresholds in ears with residual perforations are prone to fluctuation, ongoing audiological monitoring is recommended at shorter intervals than for children with stable SNHL. Ideally, J.S. should undergo repeat audiometry every three to six months, or sooner if the family or teacher notices changes in listening behaviour or school performance (Chapter 5). HA re-verification should accompany these assessments to ensure that amplification remains appropriate for his current thresholds.

Finally, functional listening assessments, such as speech-in-noise testing or parent- and teacher questionnaires, may help quantify the extent to which J.S. continues to struggle with localisation and hearing in noisy environments, given his unilateral loss. In some cases, supplementary classroom accommodations (preferential seating, remote microphone systems) may be warranted, even when audiometric thresholds are within or near normal limits

(Chapter 13). Such multimodal support ensures that auditory access and academic participation remain optimised while surgical and audiological management plans are refined.

Vestibular considerations

Vestibular assessment, as outlined in Chapter 7, is an important consideration for J.S., given his teacher's report of clumsiness and balance concerns. In the presence of chronic CHL and middle-ear pathology, certain vestibular tests may yield misleading results if their limitations are not accounted for. Caloric irrigation, for example, may produce reduced or absent responses when the tympanic membrane is perforated, even in the absence of true vestibular hypofunction (Jacobson et al. 2019; O'Reilly et al. 2010). In addition, water calorics are generally contraindicated when there is an active or recent history of middle-ear infection, due to the risk of introducing pathogens into the middle-ear space or resulting in further injury to the middle ear. Where caloric results are absent or inconclusive, supplementary testing should be used to obtain a more accurate picture of J.S.'s vestibular function.

Bone-conduction vestibular evoked myogenic potentials (BC-VEMPs) provide an important alternative in these cases, as they bypass the conductive component of the auditory pathway and directly stimulate the vestibular end organs via skull vibration (Murofushi et al. 2011; Rosengren et al. 2019). Air-conduction VEMPs (AC-VEMPs) are often absent in CHL, even when vestibular function is intact and may therefore lead to false-positive findings. BC-VEMP testing, incorporating both cervical (cVEMP) and ocular (oVEMP) responses, can be used to assess saccular and utricular function without reliance on middle-ear status. In combination with video head impulse testing (vHIT) and/or rotary chair testing, this approach offers a comprehensive evaluation of semicircular canal and otolith function. As with all paediatric vestibular assessments, it will be important to use age-appropriate instructions, minimise test duration and schedule assessments at a time when J.S. is alert and co-operative, to ensure reliable results.

Interdisciplinary considerations

Interdisciplinary collaboration, as outlined in Chapter 14, is essential to ensure that J.S. is managed holistically and effectively. This requires professionals to work together to understand his difficulties and strengths and to develop a coordinated management plan. The ENT

specialist will determine the best approach for managing his middle-ear pathology, which will guide the audiologist in selecting the most appropriate amplification for J.S.

To gain insight into how J.S. functions in everyday contexts, feedback should be obtained from him and his parents through open-ended questions and classroom performance questionnaires. Input from his teacher on observed difficulties and coping strategies will further inform decisions. The audiologist, speech-language pathologist (SLP)- and teacher should collaborate with J.S. to select appropriate classroom modifications and supports, such as preferential seating (with the better ear closer to the teacher), use of an RM system to reduce background noise, pre-teaching of key concepts and assigning a classroom buddy (Howard 2021).

A speech-language therapy assessment will provide the team with a profile of his language abilities and phonological awareness skills, both of which are often affected in children with chronic CHL (Rosenfeld et al. 2016; Savegnago et al. 2024). An educational psychology assessment may help identify other coexisting challenges related to academic functioning or attention. However, it is important to note that the symptoms of HL can be difficult to distinguish from attention difficulties (Elbeltagy 2020); here, interdisciplinary input will be crucial for accurate interpretation. At seven years of age, J.S. may be increasingly self-conscious among peers about his HL. Even mild HL can significantly affect language development, academic performance and socioemotional wellbeing (Elbeltagy 2020). The team should therefore address any psychosocial or emotional barriers to his use of hearing technology and consider strategies for fostering understanding and support among his peers and teachers.

Ultimately, an effective management plan depends on professionals working collaboratively with the child and family to establish shared goals and priorities. The team should support J.S. and his family in identifying priorities for an intervention plan that is both needs-based and family-centred.

Case study 3

Name: M.J.

Age: 3 years old

Background history

M.J. is a three-year-old female who was delivered at term following a healthy pregnancy. During delivery, she aspirated amniotic fluid and required admission to the Neonatal Intensive Care Unit (NICU) for 20 days, where she received oxygen therapy and a blood transfusion. As part of the NICU protocol, newborn hearing screening (NBHS) was conducted, which indicated a refer result in both ears. Her medical history since the neonatal period has otherwise been unremarkable, and she enjoys good physical health. Her overall development (apart from speech and language) is reportedly on par with her peers. There also appears to be a family history of HL, as her paternal uncle has childhood-onset HL.

Despite the failed NBHS result and family history of HL, follow-up testing was delayed, and M.J. was only formally diagnosed with bilateral sensorineural hearing loss (SNHL) at the age of two years. Electrophysiological measures were conducted, including screening otoacoustic emissions (OAEs) (Figure 17.3), click ABR (neurological evaluation), tone burst Auditory Brainstem Responses (threshold estimation), air conduction (Figure 17.4) and CE-Chirp bone conduction (threshold estimation ABR) (Figure 17.5). Click ABR (neurological), tone bursts (air conduction) and CE-Chirp bone conduction (frequency specific ABR) tests were conducted using the GSI Audera System. Masking was applied with every test. The patient was sedated with 6.5ml Chloralhydrate and she slept well throughout the tests. She was monitored by a sedationist for the duration of the test.

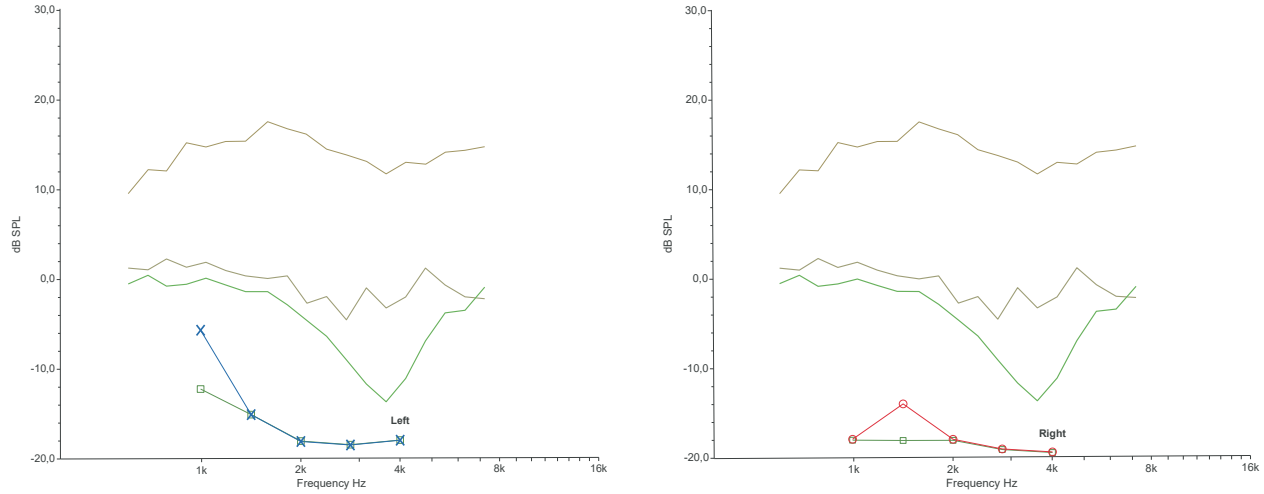


Figure 17.3: DPOAE screening results

During the neurological Click ABR evaluation, clear wave I, III and V waves could be elicited with a click stimulus of 85 dBnHL, bilaterally. The interpeak latencies between wave I – III, III – V and I – V were within normal limits for this age-group, bilaterally.

During the tone burst (frequency specific) threshold estimation ABR with air conduction, there appeared to be (electrophysiologically) a threshold shift at 500 Hz – 8 kHz, bilaterally (moderate). With CE-Chirp bone conduction there seemed to be (electrophysiologically) a threshold shift bilaterally at 1 kHz – 4 kHz (moderate), with a borderline normal threshold at 500 Hz, bilaterally. Results indicated a moderate SNHL bilaterally (Figure 17.4).

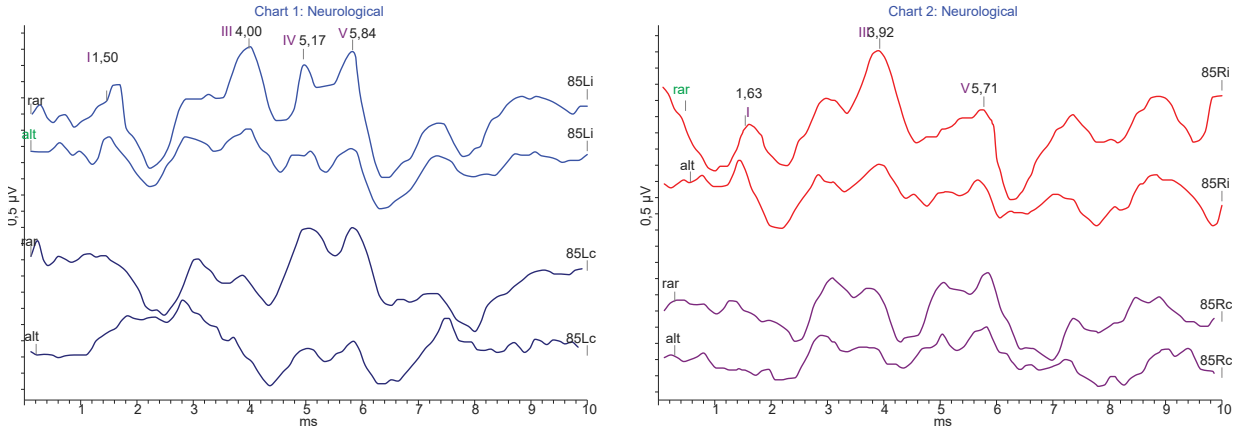


Figure 17.4: Click ABR (neurological evaluation)

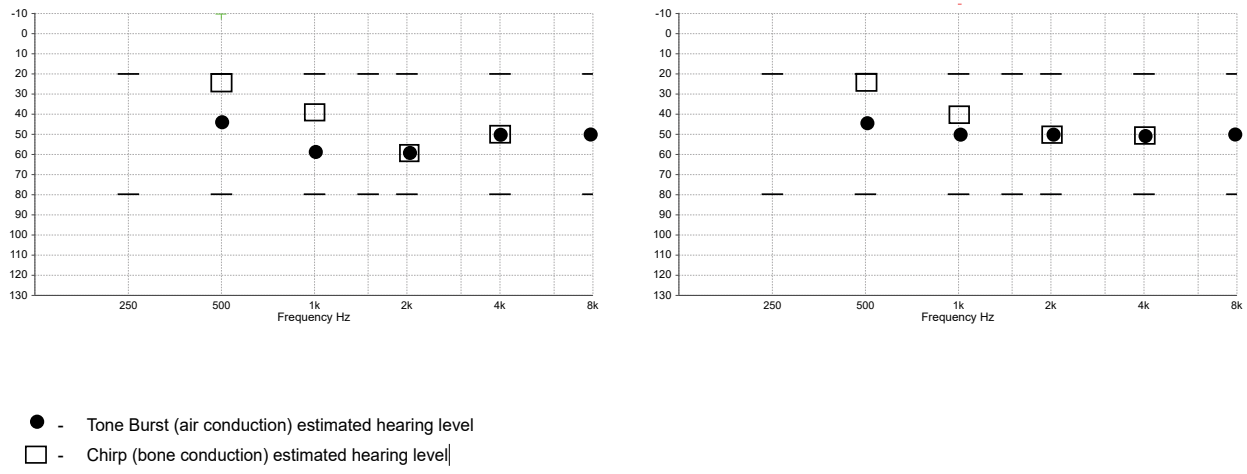


Figure 17.5: Tone burst air conduction and chirp bone conduction results

Following her diagnosis, M.J. was fitted binaurally with HAs with Speech Intelligibility Index (SII) scores at the time indicating good access to the speech spectrum. Initially, her parents noticed some improvement in her responsiveness after amplification. However, her speech and language skills did not progress as expected, and by age three her parents reported concerns that her speech appeared to be regressing.

M.J. was reassessed at this stage (age three years), using behavioural testing via play audiometry. Insert-earphones (air conduction) and a bone oscillator (bone conduction) were used and ear-specific results for frequencies 250 Hz - 6 kHz were obtained by conditioning M.J. with the bone oscillator to place a coloured ball in a bucket in response to vibro-tactile stimulation. The bone oscillator was used for the conditioning phase due to the suspected decline in air-conduction thresholds (the audiologist wanted to make sure that M.J. understood the task of placing the ball in the bucket in response to an audible - in this case tactile - auditory stimulus). M.J. co-operated well with the game initially, but tired after a few ear- and frequency-specific results were obtained. The audiologist initially obtained 500 Hz, 2 kHz and 4 kHz alternately in each ear. The audiologist then gave M.J. a break to reset and used a stacking 'build-the-tower' game to obtain the rest of the results.

Overall results from diagnostic play audiometry revealed bilateral moderate-to-profound sloping SNHL, confirming a decline in her hearing and indicating a progressive SNHL (Figure 17.5). SII results indicated limited benefit from her HAs during the follow-up session (Figure 17.6).

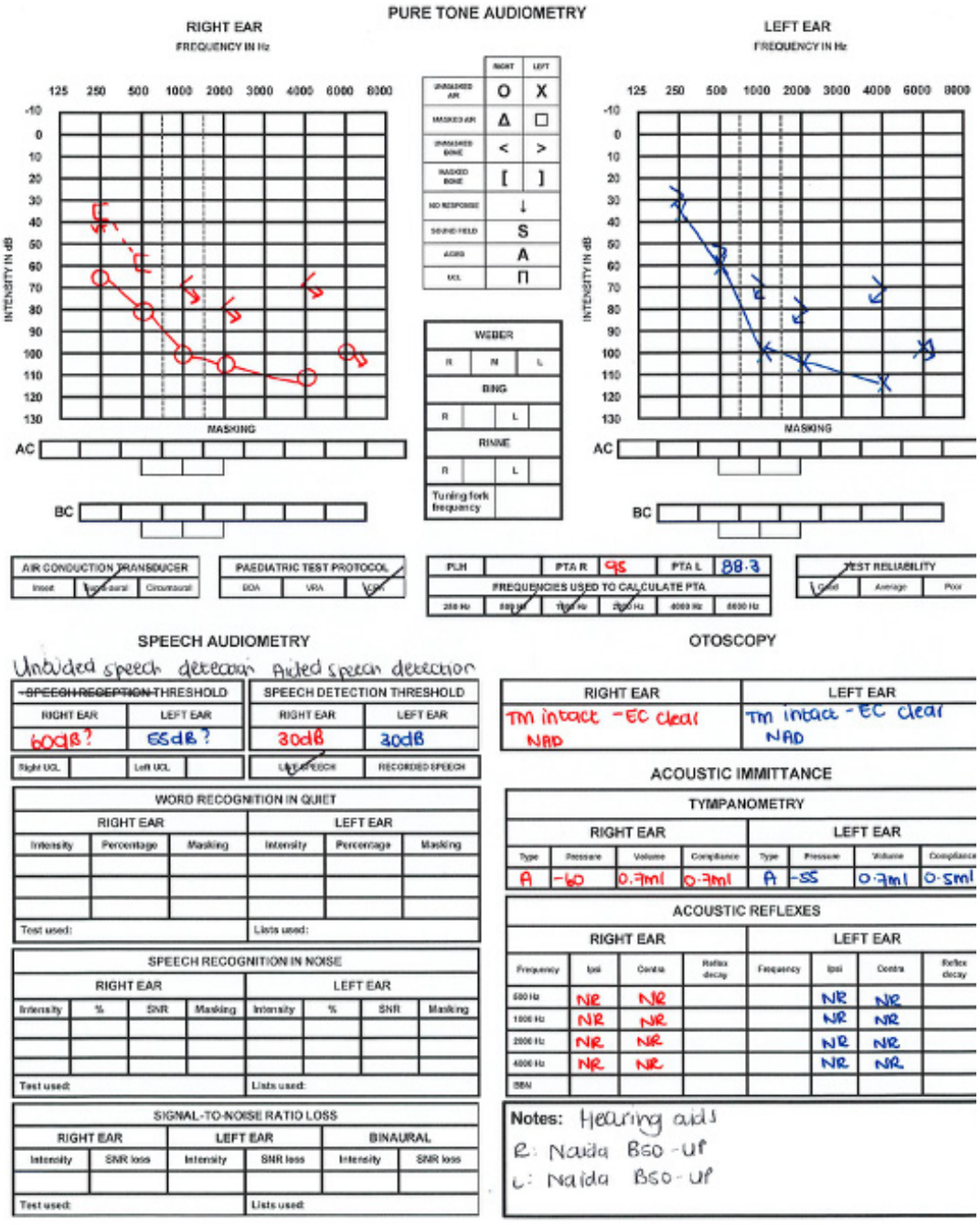


Figure 17.6: Follow-up audiometric findings at age three

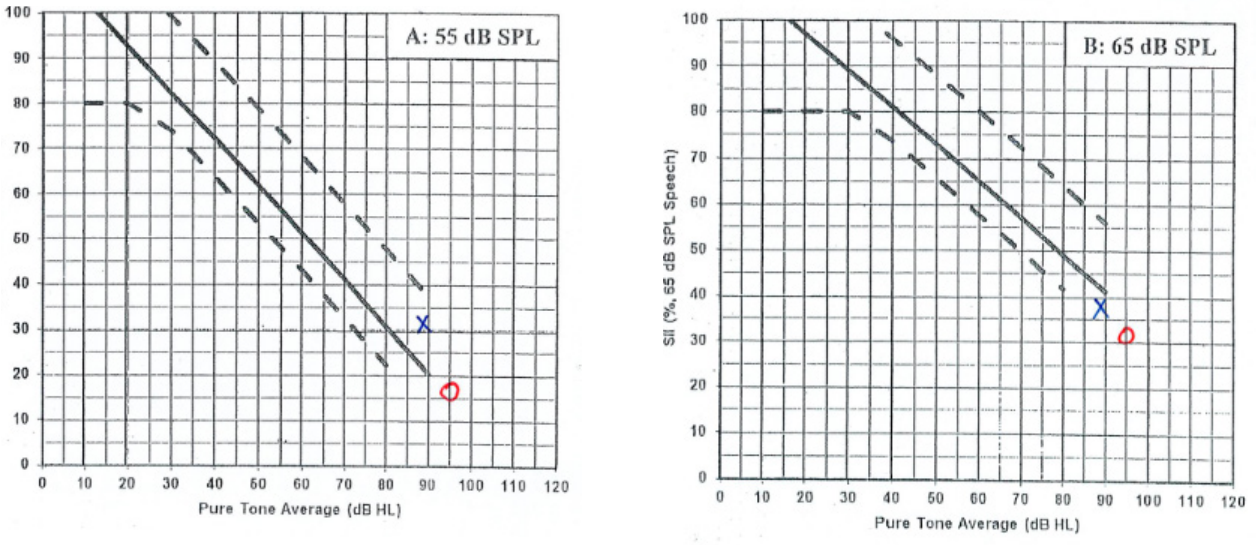


Figure 17.7: SII results at follow-up

A cochlear implant (CI) evaluation is highly recommended as soon as possible due to the limited benefit she is gaining from conventional amplification.

Scenario one:

M.J.'s parents have medical aid and are in a position to financially cover immediate and future costs of CI. They are also motivated and have the necessary support structures in place to assist M.J.

Considerations for fitting technology

Referral for evaluation for possible CI should be considered for M.J. Her (unaided) PTA audiometric thresholds bilaterally are ≥ 70 dBHL and she is demonstrating poor functional performance with limited further development in speech-language skills (Warner Czyz et al. 2022). Although her aided Speech Detection Thresholds (SDT) are 20 dBHL bilaterally, her SII scores bilaterally are significantly poorer than 0.65. This demonstrates M.J. does not have sufficient aided access to speech sounds across the speech spectrum which would

negatively impact on her ability to further develop age-appropriate spoken language, with the left ear being poorer than the right ear. The referring audiologist should provide the CI audiologist with information about the datalogging history for both ears.

Drawing from Chapters 11 and 15, considerations for candidacy and proceeding with assessment by the CI team include:

- Motivation of the family (parents) to consider CI. A lifelong commitment to audiological (mapping and assessments) and rehabilitation management is required. The procedure will require surgical intervention initially and the parents will need to understand and commit to everything that will be involved. They should desire a spoken language outcome for their child and all communication options should be discussed.
- These factors should be discussed thoroughly so that the parents (and possibly extended family) can make an informed decision. The need for counselling/psychological support should be addressed. Financial support (both for the procedure and for the long-term costs of the device and processes) is reported to be in place should she be found to be a suitable candidate by the CI team. Long-term commitment and costs should be explained to the family.
- Should their medical aid decline cochlear implantation, the possibilities for state support for the costs of cochlear implantation as well as long-term maintenance costs will need to be discussed with the family.
- Appropriate educational facilities are available for M.J.'s future educational placement.

Considerations for outcomes include the following:

- M.J.'s HL has been progressive (initially diagnosed as ‘moderate’ SNHL), that is, she has previously had better access to the speech spectrum and developed some spoken language. This means that the auditory system has been stimulated, which is a positive predictor.
- Positive predictors are therefore her age (under three years) and the presence of progressive HL.
- However, her HL was only identified at the age of two years. She therefore already had a two-year delay in intervention.

- It was also reported that M.J. is healthy and showing no obvious signs of other delays as she is developing on par with her peers (other than speech/language).
- However, due to the 'stormy' neonatal period there are some risk factors for possible developmental or learning delays. This highlights the importance of referral for Occupational Therapy and also possibly a Neuro-paediatric developmental assessment.

Assessment by the CI team include:

- Aided thresholds confirming that the HAs do not provide sufficient access to the speech spectrum, particularly in the middle- and high frequencies. CI would be the most appropriate technology to recommend for M.J.
- ENT referral for comprehensive medical assessment and possible further medical referrals if indicated. The ENT surgeon will explain the surgical procedure in detail.
- Radiological assessment to confirm that the anatomy of the cochleae and auditory nerves are suitable for insertion of the electrode array.
- Referral to a speech-language therapist who is skilled in providing early family intervention for children with HL who are learning to speak. This therapist should be a member of the CI team. The previous history of compliance and progress in therapy as well as datalogging history and history of HA use bilaterally should be explored.

Should all the above factors be accounted for and confirm CI candidacy, cochlear implantation should proceed without further delay, ideally bilateral simultaneous implantation or if only one implant is available to implant the poorer (right) ear first.

Educational placement considerations

For children with HL, decisions regarding educational placement cannot only be made the year before school-going age. The availability and accessibility of appropriate educational options often drive these choices, particularly in resource-constrained educational settings experienced in low-resourced contexts. This is obviously not the desired manner in which educational placement is chosen, but it is the reality. If the family chooses a particular mode of communication (signed vs spoken language), they require counselling on the availability of education options using that communication mode (Chapter 15).

In a case such as M.J., who was diagnosed late with a progressive HL and taking into account her existing speech and language delay, she would most likely require special-needs education, particularly for the foundation phase (Chapter 13). This would be in addition to extensive rehabilitation with a listening and spoken language speech therapist while learning to use the electrical hearing which CI provides. Special-needs education in this case could be a special-needs school or an inclusive school environment with a dedicated facilitator and IEP. A traditional school for the deaf, which primarily offers signed-based education would not be suitable for M.J. Her learning environment would need to be language-rich with a multidisciplinary team approach to facilitate the most effective opportunity to bridge the speech and language gap.

As outlined in Chapter 15, parent/caregiver commitment is essential in this case as they would need to manage the team, particularly if the team of healthcare professionals are not all school-based (which is most often the case). The curriculum choice at special-needs education level should afford the opportunity for M.J. to move to mainstream education should her team collectively decide it is in her best interest. This will largely depend on whether M.J. can close her speech and language gap with appropriate hearing technology and effective speech and language rehabilitation However, this also depends on the mainstream classroom situation. Considerations include: number of children per teacher, availability of assistants, academic/remedial support at school, level of co-operation of the teaching staff for remote microphone use and support of devices, classroom acoustics and opportunity for adaptations. In lower-resourced countries, the teacher-to-student ratio is one of the most significant determinants of whether a child using hearing technology can successfully cope in a mainstream educational environment. These factors must be considered at the individual school level.

Scenario two:

M.J.'s parents do not feel comfortable with surgical intervention and do not have the financial resources for CIs. They have decided to opt for a visual communication approach.

Considerations for mode of communication

M.J. has had some access to the spoken language, but with the decline in her hearing and limited benefits of her HAs, future barriers in language development and communication

can be expected. Since her parents do not wish her to have surgical intervention and cannot afford a CI, M.J. presents as a perfect candidate for manual communication.

It is suggested that the parents be called in for an Individualised Education Plan (IEP) meeting to discuss the various options of manual communication that are available. These need to be clearly explained in a non-biased way with the pros and cons of each modality explained in terms of their expectations of spoken language development.

If her parents wish for M.J. to continue to develop spoken language, then considering the use of Cued Speech/Cued Language at home can provide that access visually. Cued Language in the home has a greater impact than just being used at school. If they wish to keep her in a mainstream hearing setting then appropriate classroom management would include her teacher, a buddy or friend and certainly key family members and carers learning to cue the language of learning and teaching if it is different from the language of the home.

Using Cued Speech both at home and school consistently even with M.J. wearing her HAs will provide clear, optimal and relevant access to language at all times. Most importantly, it will reduce the levels of stress and exhaustion that come with hours of concentrating during the course of the day. If her parents wish M.J. to continue to progress in verbal communication then further support can be offered if her speech therapist learns to cue too, using visual cues that prime the brain for the target sounds. This will reinforce what she hears and eliminates the need for guessing and constant repetition and will naturally develop lip-reading skills when conversing with people that do not cue or sign. If M.J.'s parents wish her to establish her identity as a Deaf learner then they can motivate for placement in the nearest school for the Deaf where sign language is the language of learning and teaching. The family and carers will then also need to learn sign language, an entirely new spatial language, to support M.J. in her signed language development and to ensure open communication with her in the future.

Educational placement considerations

Some schools for the Deaf have components of Total Communication, but today most schools for the Deaf teach sign language as the Home Language and the First Additional Language is taught through writing. Additionally, most schools for the Deaf offer sign language classes for parents and family members. Still a new modality in South Africa, the use of South African Sign Language and a Cued Language in a manual bilingual setting is limited

to only a few schools. It is worth advocating for this combination to be introduced in more schools for the Deaf as it provides intact access to both South African Sign Language and the Language of Learning and Teaching, allowing for parallel development in both languages (Chapter 13).

M.J's parents' decision not to go ahead with CI means visual communication will be the most effective language environment for her education. The Deaf school of their choice should be determined by the language they speak at home (English or other) as the school will teach the first additional language in a spoken language and communicate with parents in this same language.

Interprofessional team considerations

It is essential that all children diagnosed with HL are promptly referred to an appropriately trained speech therapist. The therapist plays a critical role in facilitating the child's language development while also supporting parents in coming to terms with the diagnosis and guiding them through decisions regarding device options and language approaches.

Before families make a final decision about pursuing a CI or not, they should be provided with comprehensive information on all available options. This process should include referrals to home-based family support services, opportunities to connect with parents of children who use sign language, as well as those who have chosen CI. Caregiver support groups or buddy systems can be invaluable in helping families navigate their hopes, concerns and uncertainties. In addition, psychological support may be beneficial in assisting families to process their emotions and choices.

Following a period of speech therapy, an interdisciplinary team meeting should be convened to review the child's progress and assess their potential for language and listening development. The family's capacity to attend therapy, whether through in-person sessions or telehealth, must be taken into account. Based on these discussions, the team can make informed recommendations regarding intervention. Using an agreed-upon framework for interdisciplinary meetings ensures robust, holistic dialogue. A subsequent family meeting with the team will then enable parents to make an informed decision in a collaborative, goal-directed process.

Conclusion

In conclusion, paediatric audiological care demands a balance of evidence-based precision, contextual awareness and family-centred compassion. This book illustrated how theory and practice intersect, showing that early, individualised intervention supported by strong interprofessional collaboration leads to the best outcomes for children with HL. By integrating diverse perspectives, case studies and global approaches, the content reinforces the adaptability required in real-world clinical contexts. The consistent emphasis on empathy, innovation and partnership with families reflects the broader vision of person-centred care aligned with global health goals. Ultimately, readers are encouraged to carry forward these principles in their practice to ensure that every child has equitable access to effective and life-changing hearing care.



Test your knowledge:

Based on the content covered, answer the following questions:

1. Why is early, individualised, and family-centred intervention considered essential in paediatric audiological care, and how does it influence long-term outcomes?
2. How do interprofessional collaborations between audiologists, ENT specialists and other professionals contribute to effective management of paediatric HL?
3. What role do contextual factors such as family dynamics, resource availability and global service delivery models (for example, telehealth) play in shaping clinical decision making in paediatric audiology?

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