



## APPENDIX F

### **GUIDELINES FOR PRE- AND POST-OPERATIVE AUDIOLOGICAL ASSESSMENT (ADULTS AND CHILDREN) AND LONG-TERM MANAGEMENT.**

Each candidate for cochlear implantation presents with a unique set of capabilities and needs. Although the factor of severely compromised hearing is common to this group, the population differs in almost every other descriptor. Age, onset, etiology, and progression of deafness, cognitive and educational level, attention, language competence, family and environment, sensory and motor skills, and personal motivation all influence the approach and considerations for assessment and long-term management (Niparko, 2009). In South Africa, the socio-economic considerations of the family should always be taken into account in decisions about candidacy and management.

Additionally, the South African context presents us with unique challenges in assessment and management, and it is imperative that collaboration exists between all role players.

Implant Centres who provide cochlear implants to children should have the following audiometric equipment and facilities in place:

1. Audiological testing will be performed in soundproof booth according to SANS 10182:2006 standards. The test should be performed in a room that is of adequate size to accommodate parent(s), child and a distractor/assistant comfortably. The size of the soundproof booth should allow for free-field testing, (2.2 meters in dimension).
2. Audiometer with sound field capability:

Loudspeakers shall be positioned at 90° azimuth (reference equivalent threshold sound pressure levels, RETSPLs, are only available for these angles of presentation) relative to, and at least 1 m from, the test position to each side (BSA, 2008). The speakers should be approximately level with the child's head; such positioning provides the most efficient means for conditioning the behaviour and establishing Minimum Response Level (MRL). Visual reinforcers (e.g., multiple animated toys individually housed in dark Plexiglass boxes; illuminated and/or activated remotely) or video reinforcement system located 90-degrees to both sides of the child at eye level (reinforcers positioned at a 45-degree angle are generally insufficient for eliciting an observable head turn); The reinforcers should be located approximately level with the child's head at a distance of 1–2 m. Close proximity between speaker and reinforcer is preferred in order to aid conditioning when using soundfield stimuli; so in practice adjacent positioning of loudspeaker and reinforcers is recommended. Reinforcers should be positioned to both sides

Earphone masking system for mid-line distracter and parent are recommended. Examination rooms must meet current appropriate South Africa health and safety guidelines.

## **A. AUDIOLOGICAL PRE-OPERATIVE ASSESSMENT**

The audiological assessment must include:

*Audiometric assessment:*

1. Otoscopic examination.
2. Determination of bilateral middle ear function using tympanometric techniques.
3. Determination of unaided hearing thresholds (air and bone conduction) at all frequencies (125 – 8000Hz) bilaterally using pure tone audiometry (5dB steps).
4. Objective hearing threshold assessment, including Stapedius Reflexes, Otoacoustic Emissions, Auditory Evoked Response Audiometry (including Cochlear Microphonics) if indicated. Electrophysiology testing should include ASSR, tone burst and click ABR (Leigh, 2019).

5. Unaided ear specific speech perception testing (recorded) if indicated.

Note: confirmation for candidacy for implantation should only be after both objective and behavioural testing confirms the degree of hearing loss (Leigh et al, 2019)

#### *Hearing Aid Evaluation:*

Each patient should have their current hearing aid provision re- evaluated and where appropriate have new hearing aids fitted or settings revised. Verification of the suitability of amplification should be undertaken.

Assessment of ear-specific aided benefit should include:

1. Aided soundfield thresholds at all frequencies (125-6000Hz) tested with warble tones (frequency modulation) at 0° azimuth (1m from loudspeaker) (5dB steps).
2. Speech perception testing:
  - 2.1. Use recorded speech materials or, in the case of younger children, live voice.
  - 2.2. Presentation level of speech materials should be 60dB SPL. (Refer to calibration figures to determine dBHL relative to dB SPL).
  - 2.3. Sentence and monosyllabic word tests are recommended according to the linguistic level of the patient.
3. Patients fitted with new hearing aids or with a change of hearing aid settings may require access to a structured programme of auditory rehabilitation. It is recommended that trials with new hearing aids or different settings be conducted.

#### *Vestibular Assessment*

1. All adults and older children under consideration for bilateral implantation (sequential or simultaneous) and any patient with vestibular / disequilibrium - related complaints to be referred for further vestibular function investigation as directed by the ENT surgeon to assist with selection of the most appropriate ear

(Stevens et al, 2017). Subjective or behavioural (e.g. BOT-2 in paediatrics) as well as objective testing may be required. The most commonly used clinically and in the literature are the calorics, V-HIT and C-VEMP to determine candidacy as well as evaluate post-operatively if concerned. The C-VEMP may be especially useful in paediatrics for children that may not tolerate the calorics and where a remote V-HIT system is not available.

2. Dizziness Handicap Inventory (Jacobsen, G P & Newman, C W (1990) to be administered if any history of dizziness / vertigo incidents reported.

### *Tinnitus Assessment*

The Tinnitus Handicap Inventory (Newman, C W; Sandridge, SA & Jacobsen, G P (1998)) should be used if the patient reports a history of tinnitus.

#### *Self-assessment questionnaires:*

Questionnaires to determine additional hearing impairment, handicap and disability as well as other non-auditory symptoms are recommended. The following questionnaires are recommended as a minimum for children 10 years and older and for adults:

1. Health Utilities Index Mark III (HUI, Mark III).

<http://www.hqlo.com/content/1/1/54>

2. Speech Spatial Qualities Questionnaire. Gatehouse, S & Noble, W. (2004) The Speech, Spatial and Qualities of Hearing Scale (SSQ). International Journal of Audiology, 43:85- 99.

Final audiological evaluation of all the above should be done no less than 3 months prior to implantation.

## **B. AUDIOLOGICAL POST-OPERATIVE ASSESSMENT**

#### *Audiometric assessment:*

1. Otoscopic

2. Unaided hearing thresholds of the implanted ear post-surgery at the day of device activation and then at one-year post-surgery interval.
2. Aided thresholds 125Hz – 6000Hz tested in 2dB steps.
3. Aided thresholds of the implanted ear/s:  
Young children, 3 monthly for the first two years, 6 monthly for the following two years and annually thereafter.  
Older children, 6 monthly for the first two years and annually thereafter.  
Adults, at 3 months, 6 months, one year and annually thereafter.
3. Speech perception testing: Age and linguistically appropriate speech perception materials should be used at the following intervals:  
Young children: 6 monthly for the first two years and annually thereafter.  
Older children: 6 monthly for the first two years, and annually thereafter.  
Adults: 6 months, one year and annually thereafter.

#### *Speech Perception testing*

Speech test materials: monosyllabic word and / or sentence materials (same condition as pre-implant) should be used. Presentation level at 60dB SPL 0° azimuth 1m from loudspeaker. Choice of material will be determined by the scores obtained for sentence testing to avoid ceiling effects. If sentence scores exceed 80% only use monosyllabic word testing thereafter.

With long-term / congenitally deafened adults lipreading may also be used together with audition to assess benefit.

#### *Self-assessment questionnaires*

The same self-assessment questionnaires used pre-operatively should be re-administered annually for the first three years post-implantation.

### **C. AUDIOLOGICAL LONG-TERM MANAGEMENT PROTOCOL**

The responsibility of long-term care lies with the implant centre. The following services should be provided:

1. MAPPING. This should be performed at a minimum of yearly intervals. After the 3-year post-activation interval adults can be seen for MAPping every alternate year and after 9 years every third year. Contact should be made with them annually to ensure that performance has not declined.  
In the case of children, they should be seen annually during their school career. After the age of 18 years children can be followed up according to the adult protocol.
2. EQUIPMENT. In the event of faulty equipment, the implant centre should provide the necessary support and guidance. In the event of a faulty sound processor, the clinic should immediately provide a loaner sound processor and the patient's sound processor should be sent for repair.
3. TECHNOLOGY UPGRADE Patients should be informed when new technology is available and assisted in the process of obtaining it.
3. REHABILITATION AND EDUCATIONAL SUPPORT The clinic needs to ensure that the appropriate rehabilitative support is provided for both children and adults. In addition, appropriate school placement needs to be ensured.

References:

1. Leigh, J., Farrell, R., Courtenay, D., Dowell, R and Briggs, R. (2019). Relationship Between Objective and Behavioural Audiology for Young Children Being Assessed for Cochlear Implantation: Implications for Candidacy Assessment. *Otology and Neurotology*. 40:e252-259.
2. Stevens, M. N., Garrison, D. B., & Kaylie, D. M. (2017). What is the potential clinical utility of vHIT when assessing adult patients with dizziness?. *The Laryngoscope*, 127(12), 2689

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