Cochlear Implant Assessment of Adults

Ellen Deres, Au.D., CCC-A
English R. King, Au.D., CCC-A

Audiology Online ● **January 22, 2016**
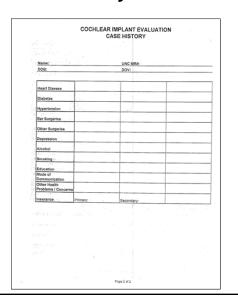
UNC
HEALTH CARE

Learning Objectives

* After this course learners will be able to identify 3 audiologic assessments that may be conducted pre-operatively.
* After this course learners will be able to list 2 medical assessments that are conducted during the cochlear implant process.
* After this course learners will be able to describe the suggested audiological course of follow-up after cochlear implant surgery.
* After this course learners will be able to name 2 sentence materials in the revised Minimum Speech Test Battery.

Topics for Discussion

* **Pre-Operative Evaluation**
  * Case History / Audiologic Testing (10 min)
  * Speech Perception Testing (10 min)
  * Medical Assessment (5 min)
* **Post-Operative Evaluation**
  * Medical Follow-Up (5 min)
  * Audiologic Follow-up Care (5 min)
  * Audiologic Testing (5 min)
  * Speech Perception Testing (10 min)
  * Original MSTB / More sensitive Assessments of Performance: New MSTB (10 min)
* **Case Studies (pre- and post-op scores)** (if time allows)

Pre-Op: Case History

Audiologic Testing

Pre-Op: Audiologic Testing

Unaided

* Tympanometry
* Acoustic Reflexes
* Pure tone AC & BC thresholds
* Speech Reception Threshold (SRT)
* Word Recognition Score (WRS)
  * Recorded
  * W-22 versus CNC
* OAEs
* ABR

Aided

* Sound field thresholds
  * Assess functional gain of hearing aids
* SRT
* Speech Perception Testing
  * Quiet
  * Noise
  * Individual ears
  * Bilateral/Bimodal

Speech Perception Testing

Pre-Op: Speech Perception Testing

* Assessment of patient performance with traditional amplification using recorded speech at a normal conversational level
* Booth Set-Up
    * Speaker to be one meter from a reference point at the center of the listener's head at 0° azimuth
    * 60 dB SPL presentation level (remember to calibrate using SLM)
    * Recorded speech testing
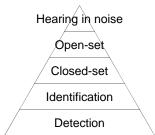   * Both speech and noise signals for the noise conditions presented from the same speaker

Hierarchy of Hearing:
Closed-set versus Open-set

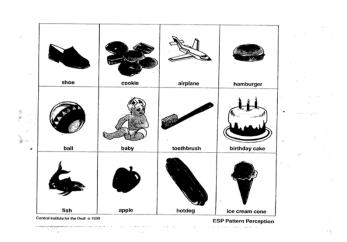**Closed-set:** limited number of choices are available to the listener
   * Early Speech Perception (ESP)
   * 4-Choice

Open-set: unlimited number of choices
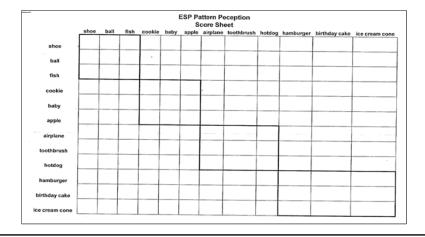   * City University of New York (CUNY) sentences
   * Hearing in Noise Test (HINT) Sentences (Quiet & +10 SNR)
   * AzBio Sentences (Quiet & +10 SNR)
   * Consonant-Nucleus-Consonant (CNC) Words
   * Bamford-Kowal-Bench Sentence In Noise Test (BKB-SIN)
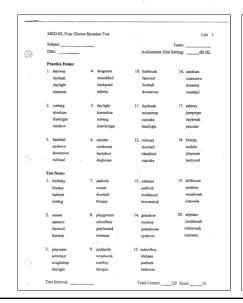
Hearing in noise
Open-set
Closed-set
Identification
Detection

Closed-Set: ESP Test Sheet

Closed-Set: ESP Score Sheet

Closed-Set: 4-Choice

Open-Set: CUNY
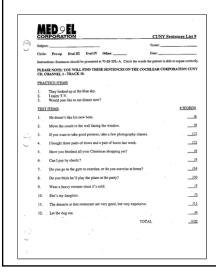

* CUNY: This test utilizes forty recorded sets of 12 sentences
* Sentences vary in length and subject matter and are not designed specifically for word recognition
* "Ready" indicator prior to start of each sentence

Open-Set: HINT

* HINT: Designed as an adaptive noise test
* Utilize in clinic with fixed noise
* Each list consists of 10 recorded sentences with no ready indicator

Open-Set: AzBio

* Developed at Arizona State University
* 4 Talkers (2 male, 2 female)
* Each list of 20 sentences contains 10 spoken by 2 female talkers, 10 spoken by 2 male talkers
* 10 talker babble is recorded on channel 2

Open-Set: CNC Words

* Developed to provide lists of monosyllabic words with equal phonemic distribution across lists
* Each list should have approximately the same phonemic distribution as the English language
* 10 lists of 50 words

Closed-Set: BKB SIN

* Designed to assess speech understanding in noise in CI listeners and those with HI
* Spoken by a male in 4-talker babble
* Prerecorded SNRs that decrease in 3 dB steps
* Results are reported as the SNR in dB at which the subject understands 50% of the key words in the sentence

Medical Assessment

Medical Assessment

* Medical examination and history review
    * Previous surgeries (ear/other areas of body)
    * Other medical conditions that prohibit surgery
* Imaging (CT scan and/or MRI)
    * Diagnose potential disease in the temporal bone
    * Evaluate tissues
* Minimum medical work-up:
    * EKG, chest x-ray, blood work (CBC, PTT, chem 7, FTA-ABS)
* Pre-op assessment by anesthesiologist
* Chronic health conditions (diabetes, heart disease, stroke, hypertension and emphysema) rarely prohibit implantation, but must be considered

Medical Follow-Up

Surgery
* 1.5-3 hours
* General anesthesia
* Same day / outpatient procedure
* External bandage worn home

Post-op
* Occurs 5-7 days post surgery
* Bandage removed
* Residual swelling
* Abnormal middle ear status

http://cochlearimplanthelp.com/journey/surgery/

Audiologic Follow-Up

Audiologic Follow-Up

* Return 3-4 weeks later for initial activation and mapping
    * Ensure patient is healing well; swelling reduced
* Approximately 6 visits are required in the first year (2 hrs. in duration) for f/u testing & programming
    * Initial Activation
    * (2-weeks)
    * 1-month
    * 3-months
    * 6-months
    * (9-months)
    * 1-year
* Annual follow-up for maintenance of external equipment

Post-Op: Audiologic Testing

With Cochlear Implant

* Sound field thresholds
  * 250, 500, 1000, 2000, 3000, 4000 & 6000 Hz
  * FM tone
* SRT
* Speech Perception Testing
* Remember contralateral masking , if needed

Unaided

Post-op hearing thresholds are often measured to assess whether the electrode insertion was atraumatic and inner ear structures were preserved

* AC & BC Thresholds (typically tested at 1-month mark)

Post-Op: Speech Perception Testing

* Assessment of patient performance with cochlear implant using recorded speech at a normal conversational level

* Booth Set-Up
  * Speaker to be one meter from a reference point at the center of the listener's head at 0° azimuth
  * 60 dB SPL presentation level (remember to calibrate using SLM)
  * Recorded speech testing
  * Both speech and noise signals for the noise conditions presented from the same speaker

Post-Op: Speech Perception Testing

* ESP, 4-Choice, CUNY
* HINT in Quiet
* HINT in Noise (+10 SNR, +5 SNR)
* AzBio
* AzBio in Noise (+10 SNR, +5 SNR, +0 SNR)
* CNC Words
* BKB-SIN

***Administration of tests is dependent on the speech understanding abilities of the listener

Testing Protocol for a "Typical" Patient

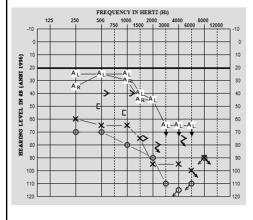|	Unaided Thresholds	HINT	HINT +10	CNC Words	AzBio	AzBio +10	AzBio +5	AzBio +0	BKB-SIN
1-month	X	X	X	X	X	X			
3-months	(X)			X	X	X	X	(X)	X
6-months	(X)			X	X	X	X	(X)	X
1-year	X			X	X	X	X	(X)	X

Original Minimal Speech Test Battery (MSTB)

* **Original** Minimum Speech Test Battery (MSTB) for Adult Cochlear Implant Users
* 1996 – Committee recommended set of materials to be used clinically and in research studies to assess the performance of adults with cochlear implants
    * **Consonant-Nucleus-Consonant (CNC) test** (Peterson & Lehiste, 1962) to assess open-set word recognition
    * **Hearing in Noise Test (HINT)** (Nilsson, Soli, & Sullivan, 1994) to assess open-set sentence recognition in quiet and in speech-spectrum noise

More Sensitive Assessments of Performance:
New Minimal Speech Test Battery (MSTB)

* MSTB for Adult Cochlear Implant Users 2011
    * AzBio sentences presented in Quiet
    * AzBio sentences presented in Noise
    * CNC words
    * BKB-SIN (pre- and post-operatively)

* Recommended presentation level of 60 dBA
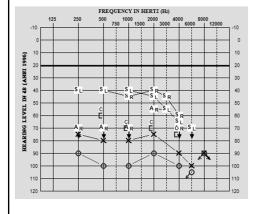* Recommended SNR of +10 or +5 for AzBio sentences in noise

Candidate 1

* 81 year old male
* Medicare age
* Consistent HA user in both ears (20+ years)
* Progressive HL, hx of noise exposure

* **R PTA:** 80 dB HL
* **L PTA:** 75 dB HL
* **R:** Severe to profound SNHL
* **L:** Moderately-severe to profound SNHL

* **R WRS:** 20% @ 110 dB HL
* **L WRS:** 36% @ 105 dB HL

Candidate 1

Interval	Condition	HINT Q	HINT +10	CNC	AzBio Q	AzBio +10
PreOp	HA R	25%	12%	16%	35%	0%
PreOp	HA L	38%	5%	4%	39%	0%
1 Month	CI R	96%	81%	52%	85%	27%
3 Months	CI R	95%	99%	54%	83%	58%
6 Months	CI R	98%	94%	58%	89%	50%

Candidate 2

* 70 year old female
* Medicare age
* Consistent HA user in both ears (46 years)
* Progressive loss with family hx of hearing loss, hx of middle ear surgeries

* **R PTA:** 95 dB HL
* **L PTA:** 80 dB HL
* **R:** Profound SNHL
* **L:** Severe to profound SNHL

* **R WRS:** 12% @ 110 dB HL
* **L WRS:** 36% @ 105 dB HL

Candidate 2

Interval	Condition	HINT Q	HINT +10	CNC	AzBio Q	AzBio +10
PreOp	HA R	DNT	DNT	22%	30%	9%
PreOp	HA L	DNT	DNT	24%	36%	16%
1 Month	CI R	97%	81%	74%	68%	36%
3 Months	CI R	98%	93%	72%	91%	49%
6 Months	CI R	96%	88%	76%	89%	49%

Questions?