Electrically Evoked Stapedial Reflexes (ESRTs)

The Electrical Stapedial Reflex Threshold (ESRT) is a useful objective measure to assist clinicians with the cochlear implant fitting process. As stapedial reflex thresholds can be established in normal hearing ears through the use of acoustic stimulation, reflexes can be elicited in Advanced Bionics' cochlear implant recipients by presenting electrical stimulation via programming software. Responses are observed and recorded on a standard immittance bridge.

The following are post-operative recommendations for measuring ESRTs using the SoundWave™ Professional Suite and SCLIN software platforms.

Equipment requirements

Clinician Equipment:

- Programming equipment
- Programming software
  - SoundWave Professional Suite
    For CII Bionic Ear® and HiRes 90K® users
  - SCLIN
    For Clarion® 1.0 or 1.2 users
- Immittance bridge

Patient Equipment:

- Platinum Sound Processor™ (PSP) or BTE/Auria® Sound Processor
- Headpiece and cable

Measuring ESRTs

Step 1: Set-up

Hardware Set-up

(1) Place the measurement probe of the immittance bridge into the patient's contralateral (non-implanted) ear

(2) Confirm normal middle ear function

a. If a normal tympanogram is not observed contralaterally, the ipsilateral/implanted ear may be used assuming normal middle ear function

b. If both ears present abnormal middle ear function, postpone testing until the underlying problem is resolved

(3) Set the immittance bridge to "Reflex Decay" mode and a 15 second time window

(4) Keeping the headpiece on the patient's head, connect the sound processor to the programming equipment as you would typically do during a routine programming appointment

Software Set-up

SCLIN Set-up screen shot

SCLIN Set-up

(1) Open the SCLIN programming software and patient file

(2) Open a new **Pulsatile** measurement ***or*** open the patient's current CIS or MPS program and use the output adjustment screen

(3) Select the **Options** tab and set the following stimulus parameters:

a. **M** duration 1000 µsec (default 50)

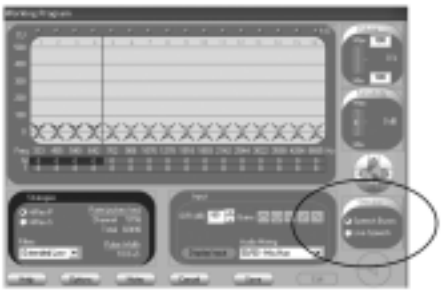
b. **T** duration 1000 µsec (default 200)

c. **Inter-stimulus time** 1000 µsec (default 1000)

SoundWave Set-up

(1) Open the SoundWave programming software and patient file

(2) From the patient management screen, open a new program and ensure that the stimulus type is set to Speech Bursts

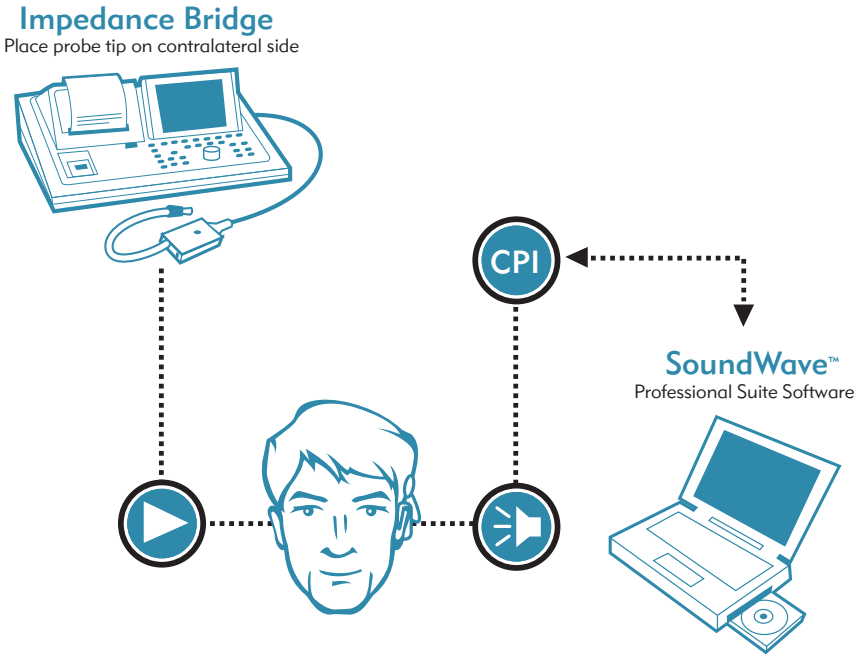


SoundWave Set-up screen shot

ESRT Set-up

Step 2: Measure M level

Use Live Speech. Globally increase M levels while saying the days of the week, etc. ***OR*** Use speech bursts (if programming in SoundWave). If M is not reached by 300 CU, skip to step 3.



Step 3: Measure ESRTs

(1) Select start on the immittance bridge to establish a baseline tracing (optional).

Tip: *Do not provide stimulation to the implant when establishing a baseline. A straight line should be observed. If not, ensure that the patient is remaining relatively still and that the probe tip is positioned properly in the ear canal.*

(2) Select your electrode(s) for testing:

a. In SCLIN, attempt to obtain measurements at the apical, medial and basal portions of the electrode array (e.g. 3,7 and11).

b. In SoundWave, select the first band of electrodes for testing (e.g. channels 1-4).

(3) Set initial stimulation level to 20% below the patient's behavioral M level.

a. If no behavioral M is available set M level to 100 CUs.

(4) Present stimulation via SoundWave/SCLIN in sets of 2-3 stimuli at a time.

Tip: *When you present stimulation, don't forget to press start on your immittance bridge (if applicable).*

Tip: *Be sure to stop stimulation frequently during testing to prevent muscle fatigue.*

(5) Using a bracketing approach, increase stimulation in small increments (~20 CUs) until a reflex is observed.

a. If a reflex is not observed by 600 CUs, repeat testing using another electrode/band of electrodes.

Tip: *Observe patient for signs of discomfort during testing. If you reach a point of discomfort and are unable to record a response, document the discomfort level and move to another electrode/band of electrodes.*

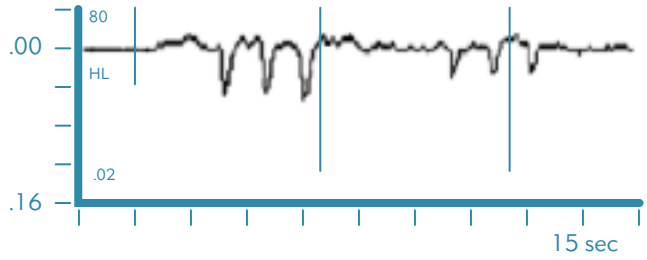
(6) Once you observe a reflex, descend in small steps (~5 CUs) until threshold is established. This level is defined as the ESRT.

(7) Document the ESRT level and repeat procedure across the array.

In SCLIN, proceed to another electrode (e.g. electrodes 3, 7 or 11).

In SoundWave, proceed to the next speech band (e.g. channels 5-8).

Typical ESRT response. Courtesy of Hodges, et al.



Measurement Tips and Precautions:

ESRTs are subject to the same limitations as when recording reflexes acoustically, therefore:

- Reflexes are absent in ~30% of the patient population.
  - *The absence of a reflex does not warrant the removal of the corresponding channel(s).*
- Normal middle ear function is necessary to record ESRTs.
  - *Remember to always conduct a tympanogram prior to testing.*
  - *Pressure Equalization (PE) tubes may eradicate recordings.*
- Reflexes are susceptible to muscle fatigue.
  - *Remember to pause frequently between stimulation sets.*

- Patients will need to remain relatively still during testing.
  - *Consider testing very young children during nap time.*
  - *Older children can be occupied through the use of videos, coloring books, etc.*
  - *Ensure adult patients are seated comfortably.*
- Reflexes are susceptible to certain muscle relaxants and anesthetics.

Step 4: Using ESRTs to Create Programs

(1) Set M levels 20% below ESRT.*
(2) Set volume control -50/0%.
(3) Turn down volume on patient's processor and turn on live speech.
(4) Slowly turn up volume control to ensure program is set to a comfortable level.
(5) Create 2 additional programs with M levels set to 10% below ESRT and M levels set to the ESRT; download to programs 2 and 3 respectively.

*Note: At initial stim, one may find that a patient's M levels fall >20% of their ESRT level as they are adapting to electrical stimulation. With time, M levels may fall closer to their recorded ESRT. ESRTs should therefore guide clinicians in setting comfort levels by indicating a level not to exceed.

If conducting an initial stimulation, try HiRes-P and HiRes-S to determine a preference or performance difference. If no difference is observed, use HiRes-S. For very young children initially select only one strategy.

Monitor progress with program with objective speech perception measures as well as subjective reports.

Using ESRTs to Verify Patient Levels

Traditionally, objective measures have been utilized as a means to set patient levels when limited behavioral information is obtained. Objective measures, including ESRTs, can also be incorporated into the fitting process to verify patient levels.

ESRTs can also be useful with patients who have difficulty assessing loudness, including very young children, the multiply involved, and long-term deafened individuals.
If a patient's behavioral M levels are consistantly higher or lower than average, consider incorporating objective measures to verify these levels.

Average M levels: SoundWave ~100-250 CUs; SCLIN <500 CUs

Try gradually increasing/decreasing patient's M-levels if there are large discrepancies between their objective measures data and behavioral levels. Remember to monitor patient's progress with objective and subjective measures as these changes are made.

If you need additional assistance, please contact your Clinical Specialist or our Audiologist-On-Call (AOC) at (877) 271-6727.