

## TESTING HEARING IN CHILDREN

There are a number of different techniques used to test hearing in children. When children are very young (less than 6 months of age), testing needs to be done without requiring cooperation from the child. Testing is accomplished by using Auditory Brainstem Response (ABR) testing and Behavioral Observation Audiometry (BOA) observing changes in sucking. For children 6-36 months of age testing is accomplished using Visual Reinforcement Audiometry (VRA) using a conditioned head turning response. Once a child is about three years old, testing is best accomplished if we can get the child to cooperate. The task is called Conditioned Play Audiometry. We teach the child to use a “Listen and Drop” task making a motor response (such as putting a ring on a ring stand, or dropping a block in a bucket) when he or she hears a sound.

### BEHAVIORAL OBSERVATION AUDIOMETRY (BOA)

ABR testing is a critical protocol for use with infants because it provides information about the auditory system without requiring cooperation from the baby. ABR measures brainstem response and estimates hearing levels but, it is not a direct measure of hearing. In addition we cannot use it to monitor how children are hearing with hearing aids. BOA is an important test protocol because it tells us what the baby is hearing and allows us to measure how they are hearing with hearing aids so we can be sure they are hearing what they need to hear.

Table 1: ELECTROPHYSIOLOGICAL VS BEHAVIORAL TESTING

<u>Electrophysiological testing</u>	<u>Behavioral testing</u>
<ul style="list-style-type: none"> <li>• Does not require cooperation</li> <li>• “Objective”</li> <li>• Can easily be obtained in infants under age 6 months               <ul style="list-style-type: none"> <li>○ Requires sedation over 6 months</li> <li>○ Newer equipment may not require sedation</li> </ul> </li> <li>• Not a measure of hearing               <ul style="list-style-type: none"> <li>○ A measure of brainstem activity</li> </ul> </li> <li>• Cannot be used to monitor hearing aids and cochlear implants</li> </ul>	<ul style="list-style-type: none"> <li>• Requires some cooperation</li> <li>• A direct measure of hearing!!!</li> <li>• Can be easily obtained in infants!!!</li> <li>• Parents can easily observe and understand test results</li> </ul>

### BOA test protocol

1. Baby resting comfortably in mother’s arms or in infant seat
2. Begin nursing, feed baby bottle, or use pacifier.
3. Observe changes in sucking. A response can be either starting or stopping sucking. Babies are consistent in how they respond. Some respond to the start of the sound, and some to the stop.
4. Start at a loud level where you think the baby will hear. When you see a response, make the sound softer. Keep making the sound softer until there are no more responses. Then start making the sounds louder until you see the response again
5. Responses should be observed 2-3 times before it is considered a response.

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6. Test low, mid and high frequencies.

The baby should be brought to the evaluation hungry so he will be ready to suck. Testing will be most reliable if attention is paid to keeping the baby comfortable, not wiggling around. If the baby becomes fussy, stop and comfort the baby before beginning testing again. It is important that everyone in the test booth be careful not to respond to the sounds so that it does not influence testing.

Testing can be performed with earphones, bone conduction, hearing aids, cochlear implants, and FM systems to be sure the baby is hearing everything we want her to hear.

### **VISUAL REINFORCEMENT AUDIOMETRY (VRA)**

VRA uses a conditioned head turning response to measure response to sound. The reinforcer can be as simple as a flashlight in a dark room or, even better, a movable toy. The reinforcer should be off to the side so it is not directly in the baby's line of site.

The child is seated comfortably on a parent's lap, or in a highchair. A test assistant sits in front of the child and keeps him focused in front holding toys or puppets to keep the child's attention. Sounds are presented and paired with the toy or light. The child may look up at the sound but she may not. After the sound has been on for a second or two, the toy should be turned on. If the child does not look at the toy, the test assistant should point to the toy to get the child to see it. After a few pairings of the sound and the toy, the child should make the association and begin to look when she hears a sound. In this way, thresholds can be obtained.

#### VRA test protocol

1. Seat the child comfortably on a lap, or in a highchair
2. Face the child forward, test assistant keeping the child focused forward
3. Pair the sound with the VRA toy to condition the child to respond
4. Start at a loud level where you think the baby will hear. When you get a response, make the sound softer. Keep making the sound softer until there are no more responses. Then start making the sounds louder until you see the response again
5. Responses should be observed 2-3 times before it is considered a response.
6. Test low, mid and high frequencies.
7. Do not present sound too close together or the child will become bored with the game and stop cooperating.

Testing can be performed with earphones, bone conduction, hearing aids, cochlear implants, and FM systems to be sure the baby is hearing everything we want her to hear.



VRA toy -

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### **CONDITIONED PLAY AUDIOMETRY (CPA)**

CPA is a "Listen and Drop" game. We ask the child to listen for a sound, and then drop a toy into a bucket, or put a ring on a ring stand when she hears the sound. CPA requires cooperation from the child. If we use interesting toys we can easily keep a child interested for long enough to get lots of testing accomplished. Blocks, puzzles, chips, pebbles, all of which can be dropped into a bucket are good. Ring stands also work well. It is important to have many toys available so when the child becomes tired of a toy you can quickly change to another.

Some children will learn this task easily simply by being told what to do. We will say "Hold the toy near your ear and drop it in the bucket when you hear the sound." We may then either make a noise or say "Put it in". The first few times, the test assistant may help the child by moving his or her hand from the ear towards the bucket. When the child starts moving his hand towards the bucket by himself, the test assistant will drop her hand.

When practicing, start by letting the child see your face if you are using a voice stimulus, or see the toy that is making the noise if you are using a noise toy (bell, drum, pot and spoon). The child will begin by using both visual and auditory cues. When he can do the task by himself using both visual and auditory cues, drop the visual cue and try auditory alone. The person making the noise should sit behind the child so he has no visual cues and must rely on listening to know when to respond.

When the child seems to have the task, practice making the sounds softer, and try different sounds. Be careful to change the rhythm of the presentation so you are not presenting the sound every 50 to 60 seconds or the child may get into a time pattern and not be responding to sound at all.

This should be a game for the child so find some interesting toys and make it a game.

Testing can be accomplished with earphones, bone conduction, hearing aids, cochlear implants and FM systems.

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