

BIAP Recommendation 12-8 Audiometric procedures in the first year of life

Part: 12-8.1.5: Behavioral Observation Audiometry (BOA)

General foreword

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Recommendation

Behavioral audiometry is an essential part of the audiological assessment of very young children. Before the age of 6 months behavioral reactions of the child to sounds are observed to estimate the child's hearing. All physiological measures (ABR, tympanometry, OAE) should be complemented with behavioral measures. The purpose of behavioral audiometry will be to obtain air and bone conduction data as close as possible to the hearing threshold for a broader frequency range of at least 500 – 4000Hz.

Behavioral audiometry should be applied by well experienced audiologists and has to be performed in the context of a multi professional network. Beside the physiological measures it should be based on a good anamnesis and it needs a trustful atmosphere with the caregivers. Experiencing the hearing reactions of the child to different sound pressure levels can also help the caregivers to understand better the hearing problems of their child. So behavioral audiometry is a time-consuming measurement that has to be done in optimal conditions:

soundproof booth with no distracting materials and the child has to be in a vigilant state + parent(s) have to be present. Ideally, BOA with neonates should take place during feeding or during a light sleep.

It is very important to build up the intensity of the stimulus from quiet to loud, and to switch the frequency frequently. As soon as a clear reaction is observed, the test moves on to another frequency. For threshold evaluation in the first few months of life this recommendation concentrates on hearing losses of more than 30 dB, which may need amplification. To reach that goal it is preferable to start with bone conduction (if that is tolerated by the child) in order to determine the responses of the best inner ear immediately. One can then proceed to measuring with insert phones (with a binaural stimulus or ear-specific). As soon as the child got hearing aids attach the insert phone to the child's ear mould. If the child does not except insert-headphones or bone-conductors at least air-conduction hearing reactions may still be obtained under free-field conditions, but these hearing reactions may be further away from the real threshold then obtained with insert

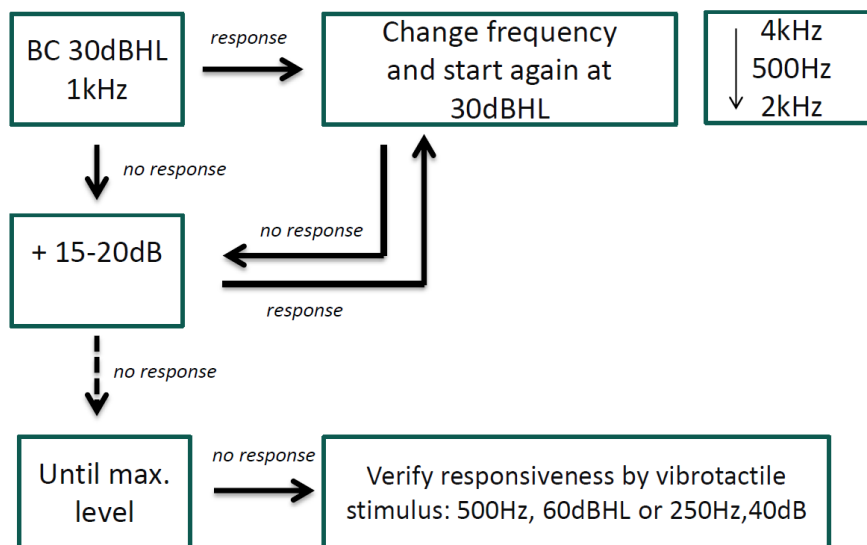
phones or bone-conductors.

The most frequently observed behaviors consist of: opening the eyes, blinking the eyes, frowning or changes in sucking, breathing or other motor activities.

Important to know:

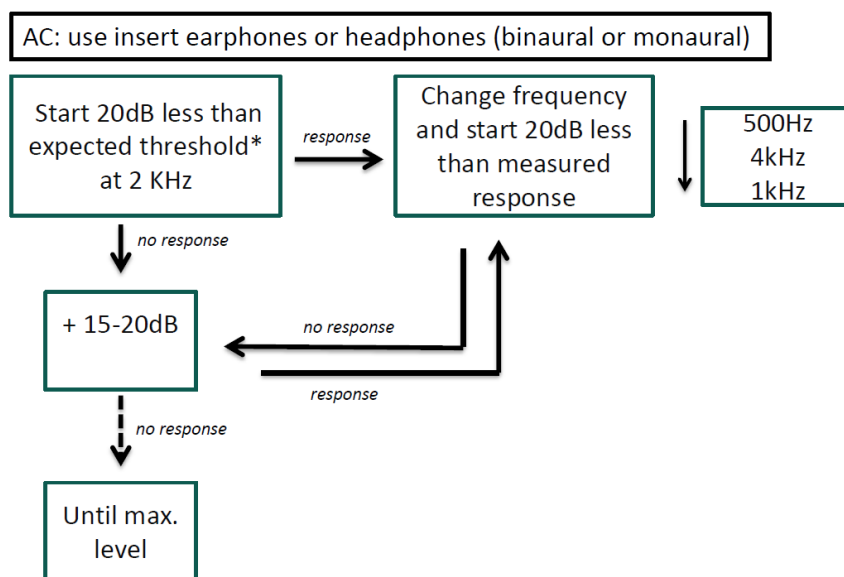
- In threshold estimation with BOA, a clear distinction has to be made between neonates with normal hearing and neonates with a hearing loss. While normal hearing babies have elevated (= louder) response levels, hearing-impaired babies with a loss of 50 dB_{HL} or more the response is closer to the real hearing threshold in most of the cases. One possible cause is the phenomenon of recruitment, which results in a faster increase in loudness perception in cases of a sensorineural hearing loss. Another cause is that babies with a hearing loss can be surprised more easily and respond faster and clearer to an unexpected new sound even it is just above their threshold level.
- For babies the number of reliable responses in one session is limited (depending on the condition of the child it can be even less than 10-15 responses overall), so the responses that can be elicited have to be utilized as effectively as possible. Therefore when obtaining the minimal response level of the child it is necessary to start always below the expected threshold with a warble tone or “FRESH noise” (a NB-noise that is designed and calibrated for threshold evaluation) or a bi-tonal stimulus (special option of the audiometer to rapidly switch manually between two neighboring frequencies, see Delaroche M.).
As a starting point for the testing an estimate of the expected threshold can be obtained from the results of the objective measurements (ABR and OAE).
- Mostly it will not be possible to confirm a reaction twice by immediately repeating the same stimulus (because of a very quick habituation). So you have to confirm the reaction after testing a stimulus of a different frequency or at another session.
- We recommend to respect the following protocol (s. flowchart):
 1. Otoscopy and high frequency tympanometry to rule out obstructions of the ear canal and middle ear ventilation problems
 2. ABR threshold estimate for the frequency area around 500Hz and between 2000-4000Hz
 3. Start BOA with bone conduction at 30dB, change frequency as soon as a clear reaction is observed. Use frequency steps greater than usual, like 1000Hz → 4000Hz → 500Hz → 2000Hz (s. flowchart, fig. 3)
 4. Proceed with insert earphones (if the child already got a hearing aid, the insert phone can be attached to the child’s ear mould) on the better hearing side (s. flowchart, fig. 4)
 5. When a child already got its hearing aids a BOA with hearing aids is another important crosscheck for the previously ascertained hearing reactions and the estimated hearing threshold based on these reactions.

Fig. 3 Flowchart: BOA with Bone Conduction to determine the hearing threshold of children 0-6 (12) month with a hearing loss of more than 30 dB, which may need amplification.



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Fig. 4 Flowchart: BOA, Air Conduction



* Use information from BC or AC ABR-threshold best ear

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This recommendation was created and approved in multidisciplinary cooperation between professionals of all audiophonologic disciplines, which are medicine, pedagogy, speech therapy, psychology and hearing instrument audiology.

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