The distraction test for checking hearing in a low-resource setting

From 7–8 months

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Rationale

The distraction test is a hearing test that relies on infants' normal turning response to the source of a sound. During the test, the infant sits on the parent's lap whilst their attention is controlled by a tester in front of them. Sounds are presented behind the infant on each side and the tester evaluates the infant's response.

The test can be used as a screening test by specially trained primary health care workers. Any infant who fails the test needs further testing by an audiology team. If the hearing loss is confirmed, appropriate communication choices (e.g. signing, speech) will need to be made according to local resources and parental choice.

Age range

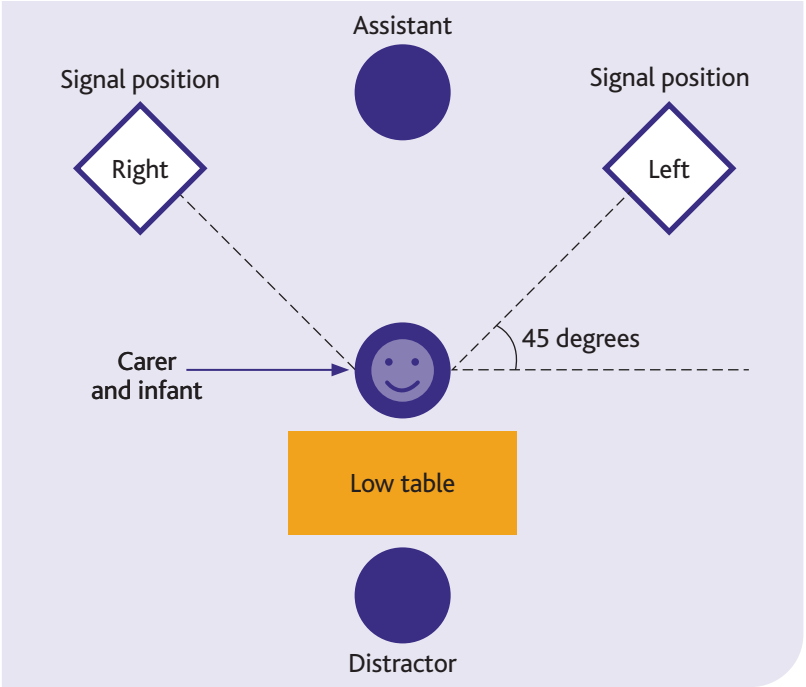
- The distraction test is best carried out on infants around the developmental age of 7 to 8 months if they can sit without support and turn their head from side to side. It can also be attempted on babies who have reached this stage from the age of 6 months.
- The test can be used up to the age of about 18 months, but it becomes progressively more unreliable with age: the infant learns to inhibit turning in response to sound and becomes more interested in the play in front or becomes uninterested in the situation and makes random turns which can easily be misinterpreted as responses to sound.

Test requirements

A suitable room

- The room should be quiet. The level of background noise should be consistently low during the test (less than 35 dBA). You should not be able to hear any activity from outside the room (e.g. traffic or voices) or internal sounds (e.g. water flowing in pipes). The test should be paused if there is any temporary noise, but this should not happen often (e.g. there should be no frequent traffic or footsteps). If rain hits the roof or windows, it may be necessary to postpone the test.
- The light in the room may be natural (window) and/or electric, but you need to check that the assistant (see Figure 1) does not cast shadows when standing in the test position behind the infant.
- Similarly, there should be no reflective surfaces in front of or to the side of the infant (including the surface of the table), which might reflect the assistant's body or stimulus. This will cue the infant and cause a false turn.
- There should be no pictures or objects which are attractive to infants and might cause them to look at them during the test.
- The room should contain an adult-size upright chair for the parent/carer and, if available, a low table for play activity.
- The room should be big enough to accommodate the infant, their parent(s) and two testers, in addition to the furniture listed above.

FIGURE 1 POSITIONING DURING A DISTRACTION TEST



Toys

You will need toys that do not make a lot of noise (e.g. no rattles). Building blocks and items that spin or roll on the table are often good toys to use.

Two testers

You will need two testers with good hearing and able to produce the 'ss' sound:

- The 'distractor' faces the child and is in charge of the test. They are the person who controls the infant's attention.
- The 'assistant' stands behind the parent/carer and makes the test sounds (see Figure 1).

Procedure

1 Introducing the test to the parents

It is important that the parents understand that this is a hearing test for infants which aims to ensure that they can hear a specific range of quiet sounds. Infants need this ability in order to develop clear speech and an understanding of speech. It is not sufficient for a child to appear to respond to sounds in everyday life, therefore all infants should have a hearing test.

You should then explain that sounds will be presented behind the infant whilst they sit on their parent's lap, to see if they turn. The parent should take care not to give any cues to their child.

2 Checking the child can turn

You should examine the infant to see if they can physically make a head turn sufficient to show a

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Distraction test: child turning to a voiced signal on the left.
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response and if they can be visually distracted. Usually, this can be observed while the test is being explained to the parent, but with some infants it will be necessary for preliminary tests to be carried out, e.g. testing the infant's ability to visually follow a moving object in a 180-degree arc from side to side.

If the infant does not have this ability then you should see them about a month later and observe them again to check whether they are ready for the test. Some infants may need to be referred for testing by an audiologist if they are not making sufficient development for the test.

3 Positioning (Figure 1)

The infant sits halfway along the parent's lap supported at the waist, facing the distractor. The distractor kneels or sits facing the infant. The assistant stands behind the parent at about one meter from the child's ear and moves as little as possible in order to avoid giving any visual or auditory cues to the test stimulus.

4 Engaging and releasing the child's attention

The distractor performs a play activity to hold the infant's attention. They reduce this play activity before the assistant introduces the stimulus, in order to slightly release the infant's attention. This phasing out of the play activity is an important aspect of the test. The infant's attention will not be oriented towards the sound if they are too engrossed in the activity in front of them.

The assistant and stimulus should be ready and waiting for the time at which the distractor phases out the play activity, rather than moving when this moment occurs. The distractor controls the timing of the test, but the assistant's role in responding to these timing cues is crucial to the success of the test.

To engage the infant's attention forward, the distractor uses a simple play activity, such as spinning a toy. This distracting activity can be modified to suit the infant's abilities: for example, if the infant is over 12 months, the distractor can gradually build a tower with toy bricks and leave it in sight, to try to prevent false turns occurring. Visually impaired children can be distracted using tactile (stroking) stimuli.

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Choose toys that do not make a lot of noise, such as building blocks

Alternatively, the room lights can be dimmed and a light source, such as a penlight torch, can be used to control the infant's attention.

To phase out the play activity, the distractor commonly covers the toy being used, while continuing to move his/her fingers or the toy in a minimal movement as the assistant presents the sound behind the child. Pauses in distracting should not be so long that they allow the infant's gaze to wander. The distractor should also take care not to distract in a manner which is so interesting that the infant does not turn even though they have heard the sound.

5 Combining test stimuli and no-sound trials

The distraction test is a mixture of specific auditory stimuli and of no-sound trials performed periodically to ensure that the infant's turning response is true.

Presenting the stimulus and recording the response:
The assistant should present the stimuli in the following manner:

- One metre from the child's ear, to enable the sound to be at the ear at minimal levels of intensity (no greater than 35–40 dBA) i.e. just audible by normal hearing persons. This should be at an angle of 45 degrees on either side behind the infant (Figure 1) to avoid visual, auditory or olfactory cues being given by the assistant. The absence of these cues is paramount in ensuring the validity of the test.
- At the same vertical level as the infant's ear, as this makes it easier for the infant to localise the sound.
- For up to 5 seconds at the initial minimal intensity levels and then louder if the child does not respond.

If the distractor deems that the baby responds appropriately, the assistant 'rewards' the baby, e.g. by touching the baby, saying 'hello' or smiling at the baby. The assistant records the baby's response or lack of response to the minimal level of stimulus on the record sheet (see Figure 2 on page 9) while the distractor guides the infant's attention to the front.

No-sound trials (see page 9) should follow the same procedure.

Auditory stimuli:
The aim is to test the hearing of low and high frequencies on each side separately, because the baby needs to hear these frequencies independently at minimal levels to develop speech. Ideally, you should also test mid-frequencies, but this requires equipment such as a mid-frequency chime bar (e.g. 'G' at c1.6 kHz) or a frequency modulated warble tone generator at 1 kHz (see 'Extra equipment' at the end of this article).

If you have no equipment:

- **Low frequencies** can be tested using the human voice. The voiced sound with the purest low frequencies is the 'oo' sound, as in 'shoe'. You can vary the pitch and the rhythm when you make the sound 'oo, oo, oo' over a few seconds, to make it more interesting for the baby. Alternatively, you can also hum a tune. It usually takes persistent practice to ensure that a voiced low frequency sound is made very quietly.

- **High frequencies** can be tested with the unvoiced and rhythmical speech sound 'ss,ss,ss'. The 'ss' should be sibilant (that is, having a whistle-like character, as at the end of the word 'yes') and is best achieved with the tongue high in the palate. This sound is easier to produce if the lips adopt a smiling expression.

For voice and the sibilant 'ss', the assistant will lean to either side (thus moving as little as possible), rather than step to each side. When using sound generators, the assistant can simply use his/her outstretched arm to hold the source at one metre from the infant's ear.

The assistant usually decides which stimuli to use and the side of presentation. They should not alternate sides in a predictable manner, to avoid the baby guessing.

No-sound trials:

In a no-sound trial, all conditions of testing are met, with the assistant and stimulus in situ and the distractor phasing attention, but the assistant does not make any sound. These trials should help the distractor to decide if the infant is turning because they have genuinely heard the stimuli or is turning for some other reason. These trials should be performed periodically during the distraction test to ensure that the infant's responses are true.

Interpreting the child's turning action

It is the distractor's role to assess whether a turn was in response to the stimulus or for other reasons (such as visual cues or other auditory stimuli) or if it was a random check. The distractor should also assess whether or not the infant has correctly localised the sound source.

The distractor should observe the infant's face as this may give clues that they have heard the stimulus prior to localising it. The distractor may, for example, notice a look of recognition such as a widening of the child's eyes or a smile prior to turning. The distractor should take care not to maintain eye contact with the infant as this may fix their attention forward: it is better to concentrate the gaze a little below the eyes. Similarly, the distractor must be careful not to glance towards the stimulus and give cues of its presence and location. In some cases, where the infant is visually impaired, the test may be modified so that a repeatable response of reaching for the stimulus may be accepted.

The distractor tells the assistant whether a turn was a true response at the minimal level of intensity or not. The assistant then records this on the test sheet (see Figure 2).

If the infant displays random 'checking' behaviour, the first thing to do is to make sure that sensory cues have not been given inadvertently. Indeed, **deaf children are particularly prone to turning to check their environment** and are sensitive to inadvertent visual cues. If there are no sensory cues, then you may stop the infant's checking behaviour by using one of the following ploys:

- phasing the infant's attention without presenting a stimulus or giving a reward for turning until the checking ceases

FIGURE 2 DISTRACTION SCREENING TEST OF HEARING: RECORD SHEET

Name of infant:		
Name of testers:		
Stimulus at minimal levels of intensity	**Right side** ✘ : No response ✓: Positive response	**Left side** ✘ : No response ✓: Positive response
Low frequency voice		
High frequency sibilant 's'		
Have no-sound trials been carried out? ☐ Yes ☐ No		
Result of screening test ☐ Pass ☐ Fail		

- keeping a toy in view to attract the infant's attention forward, i.e. providing more interesting distraction in front
- distractor and assistant changing places.

In order for the infant to pass the distraction test, they should turn to and localise correctly both low- and high-frequency stimuli at minimal levels on each side, for a minimum of two out of three trials (i.e. a total minimum of eight correct turns). If mid-frequencies are tested, then these too should produce correct turns at minimal levels in order for the infant to pass.

Additional equipment

If possible, some technical equipment can improve the quality of the test:

- **Sound level meter** (measuring down to 30 dBA): this is useful to check background noise levels and to train the testers to produce a low frequency with their voice and a sibilant 'ss' that is no louder than 35–40 dBA. This instrument is usually powered by 9V batteries.
- **G chime** (c1.6 kHz): this is useful for testing mid-frequency hearing.
- **Manchester High Frequency Rattle** (6–8 kHz): this can be used for testing high frequencies, which are most important for hearing speech clearly. This rattle is reliable and has been specially designed for testing hearing.
- **Frequency-modulated warble tone generator:** this allows testing to be done at specific frequencies, usually at 0.5 kHz, 1 kHz and 4 kHz. These instruments are usually powered by 9V or penlight batteries.

Further reading

T Sirimanna, B Olusanya. Early detection of hearing loss: an overview of methods and resources. Community Ear and Hearing Health (2014); 11 (15): 4–7.