Pure tone audiometry (Air conduction)

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The audiometer was introduced in the early 1900s. There are several types of audiometers available now ranging from the simple screening type which measures a restricted range of frequencies and intensities to the complex clinical types used in diagnostic clinics.

Purpose of the Test

Pure tone audiometry assesses hearing sensitivity. It measures the quietest sounds that can be heard at each frequency, in each ear. This is called the ‘threshold of detectability’ and is measured in decibels of hearing loss (dBHL). 0dBHL represents clinically normal hearing at each audiometric frequency. Air conduction thresholds are measured for pure tones heard through headphones placed over the ears. These thresholds are recorded on a graph called a ‘pure tone audiogram’ (PTA).

Rationale

To establish the threshold of detectability at specified frequencies in the speech range in each ear.

Criteria

The test can only be carried out if the child/adult is prepared to wear headphones and can wait and indicate in some way that a sound has been heard. The test area must be quiet enough to preclude auditory distractions.

Procedure

The procedure is explained carefully to the testee. A response is made by the testee whenever the test tone is heard, however faintly. The response may be the pressing of a button or the lifting of a finger.

It should be a silent response. The tester should be able to observe the child but not give any clues as to when the tone is being presented.

The procedure should be as follows:

- the better ear (if known) is tested first
- the headphones are colour coded, red for the right ear, blue for the left
- the results are recorded on the audiogram form as circles for right ear thresholds and crosses for left ear thresholds (unmasked)
- the test tone should normally be of 1-3 seconds duration
- the length of time between tones should be varied
- start at 1000Hz 40 dB above the estimated threshold
- increase in 20dB steps until there is a response
- decrease in 10dB steps until there is no response
- increase in 5dB steps until there is another response
- threshold is the lowest level when two out of three responses are achieved when ascending in 5dB steps
- repeat this procedure at 2000, 4000, 8000, 500 and 250 Hz for each ear.

This method is often called the ‘10 down, 5 up’ procedure.
Thresholds may vary on repeat testing especially if it is a different tester or a different audiometer. The test retest variability may be as much as 15 dB at any one frequency.

**Pure Tone Audiometry for the under five's or children with additional difficulties.**

Most children of three and a half years and over are able to complete pure tone audiometry. Occasionally children from the age of two and a half years are able to co-operate.

The child should be seated at a small table with a parent/carer sitting next to them. The room should be visually and acoustically quiet and any medical equipment covered in case the child is distracted by it. All toys and games should be kept out of sight until needed. The tester should be at the child’s side with the audiometer behind the child and out of sight. The tester has to take great care that the child does not see him/her operating the audiometer.

It is sometimes advisable to start with a performance test in order to help the child relax. The child is then conditioned to respond to a pure tone through the head set which is placed on the table or to a warble tone produced through a warble tone generator. The signal should be well above the child’s threshold. The response may be a simple game such as dropping a brick in a box, placing a peg in a board or a man in a boat. The activity has to be interesting but simple. Several different activities may be needed in order to keep the child’s interest.

The procedure can be carried out by demonstration alone or with the minimum of voiced instructions. If a child is, for example, using a board and pegs and responds when a signal has not occurred, the peg can be removed and a new one given to try again. It is important with some children not to say “No, that was wrong” as they may refuse to continue.

Young children have shorter concentration spans and therefore it is sensible to achieve the air conduction thresholds that will give you the information needed about the key frequencies to acquire speech and language. Thresholds at 1000, 4000 and 500Hz should be achieved in each ear first and then others if the child is still willing.