Pure tone audiometry (Unmasked bone conduction)
Sue Westhorp

Pure tone audiometry by bone conduction is used in conjunction with air conduction measures to gain more information about the nature of a hearing impairment.

**Purpose of the Test**

Pure tone audiometry by air conduction, using headphones, determines the quietest sounds that can be heard at each frequency in each ear, i.e. the threshold of detectability (in dBHL). Once this measure has been made, pure tone audiometry by unmasked bone conduction is used to gain more information about the nature of the hearing impairment.

The results recorded by air conduction give an overall level of hearing. This is then refined to determine which part of the hearing mechanism is giving this response. Bone conduction thresholds are measured by introducing pure tones through a vibrator which is placed on the mastoid process. Results are recorded on the audiogram in dBHL.

The vibrator can be placed on either side of the head. The signal by-passes the outer and middle ear and is delivered through the bones of the skull directly to both cochleas. The thresholds recorded will be those of the cochlea responding to the quieter stimulus. This gives information about the sensori-neural component of a hearing impairment.

Results of air and bone conduction are compared to determine the nature of the hearing impairment: conductive, sensori-neural or mixed.

**Rationale**

To establish the threshold of detectability of the better cochlea.

**Criteria**

The child/adult is prepared to wear a vibrator on a headband and can wait and indicate in some way that a sound has been heard.

**Procedure**

Generally air conduction thresholds are obtained first and if these indicate a hearing impairment then bone conduction measures can be made.

The procedure is the same as for air conduction using the 10 down, 5 up method for presentation of tones.

- the vibrator is placed on the mastoid, away from the pinna and hair. The other side of the headband is placed in front of the other pinna, on the cheek so as not to obstruct the ear canal
- the child/adult is instructed to indicate when a tone is heard
- the test tone should be of 1-3 seconds duration
- the length of time between presentations should be varied
- the signal is presented at the threshold of air conduction or just below, taking into account the maximum output of the audiometer
- increase in 5dB 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 where at least half of the responses are achieved ascending in 5dB steps.

**Note**

Unmasked bone conduction thresholds are indicated on the audiogram form with a small triangle.

The frequencies tested will be dependent on the results of air conduction testing.

Testers need to be aware of vibro-tactile thresholds when employing bone conduction audiology.

These are recognised to be:

- **250Hz**: 20-40 dBHL
- **500Hz**: 55-70 dBHL
- **1KHz**: 80-85 dBHL

These are levels at which the responses obtained may be to a stimulus that is felt rather than heard.

Bone vibrators are limited in their frequency range and the output they can give; up to 30/40 dBHL at 500Hz to 60 dBHL at 1, 2 and 4 KHz.

**Interpreting the results**

In practice a gap of 15db or more between an air conduction and bone conduction results at any one frequency is generally considered clinically significant.

Certain audiogram configurations make masked bone conduction essential.