MASKING IN PURE TONE AUDIOMETRY

Purpose of the test

The technique of masking is used in order to isolate the test ear and ensure that results obtained are the true thresholds of the test ear. In pure tone audiometry for both air conduction and bone conduction it is possible that responses obtained are those of the non-test ear.

Rationale

To establish the true threshold of detectability for air and bone conduction.

Air conduction pure tone audiometry

- It is possible for sounds introduced into the test ear via headphones to be carried by bone conduction across the skull and stimulate the cochlea of the non-test ear.
- The amount of sound energy that is lost as it crosses the skull is known as transcranial attenuation.
- It varies in individuals between 40 and 85 dB.
- It is accepted that if the difference in thresholds between the air conduction results at any frequency is 40dBHL or greater then it is possible that the response is due to stimulus of the non-test ear.
- When there is this difference of at least 40dBHL then masking is introduced in order to isolate the test ear and obtain true thresholds.
- In masking a narrow band noise centered around the test frequency is introduced into the non-test ear. This noise "occupies" the non-test ear and allows the test ear to respond at its true threshold. Pure tones are presented into the test ear in the usual way until a true threshold can be recorded.

Masking procedure in air conduction testing (This is known as Hood's technique)

- The procedure uses conventional headphones.
- The adult/child is asked to listen to the narrow band noise in the non-test ear and indicate when it is just audible. Increase the level by 20dB. Instruct the adult/child to ignore this noise and listen for the signal.
- Using the usual 10 down 5 up method, re-measure the threshold of the test ear.
- Increase the masking level by 10dB.
- Re-measure the threshold.
- Repeat the process until for two successive increases in masking level the threshold does not change.
- This gives the true air conduction threshold of the test ear.
- This technique is not recommended for very young children as they can find it difficult to understand what to do. Generally, it can be done at around age seven.

Bone conduction pure tone audiometry

In bone conduction pure tone audiometry masking for bone conduction assessment is required when there is a gap at any frequency of 15dB or more between the unmasked bone conduction result and the air conduction threshold. This is known as the air-bone gap.

Masking in bone conduction testing

- The same method is used as for air conduction.
- The bone conduction vibrator is placed on the mastoid process of the test ear.
- Masking noise is introduced to the non-test ear through an insert earphone which is placed in the ear canal and held in place by a hook over the pinna. The tone is introduced via headphone into the test ear.

Indicators of cross-hearing and the rules for masking

- Rule 1: Masking is needed at any frequency where the difference between the left and right not-masked A/C thresholds is 40 dB or more when using supra- or circum-aural earphones or 55 dB or when using insert earphones
- Rule 2: Masking is needed at any frequency where the not-masked b-c threshold is more acute than the air-conduction threshold of either ear by 10 dB or more. The worse ear (by air conduction) would then be the test ear and the better ear would be the non-test ear to be masked.
- Rule 3: Masking will be needed additionally where Rule 1 has not been applied, but where the b-c threshold of one ear is more acute by 40 dB (if supra or circum-aural earphones have been used) or 55 dB (if insert earphones have been used) or more than the not-masked a-c threshold attributed to the other ear.

Central masking

- It has long been recognized that even with small to moderate amounts of masking noise in the non-test-ear, thresholds of test ear shift by as much as 5- 7 dB. The term central masking is used to explain this phenomenon and is defined as threshold shift in test ear resulting from introduction of masking signal into non-test-ear that is not due to crossover.
- Central masking occurs due to inhibitory response within central nervous system, behaviorally measured as small threshold shifts in presence of masking noise. as a result, the signal intensity levels must be raised to compensate for the attenuation effect from the neural activity. Both pure tone speech thresholds are affected similarly by central masking phenomena.
- This refers to the inability of the brain to identify a tone in the presence of masking, even when they are heard in opposite ears; hence masking is occurring centrally rather than peripherally (in the cochlea).
- Central masking is a phenomenon that occurs beyond the ear, during central auditory processing.
- This phenomenon occurs when two stimuli are presented binaurally through well-insulated headphones: A test signal sounds in one ear while a masker sounds in the opposite ear. Although no direct interference between the stimuli occurs, a person's perceptual threshold for the test signal increases and the signal becomes more difficult to detect. This effect is most commonly apparent at the higher masking levels.