STUDY OF THE RELATIONSHIP BETWEEN THE ACOUSTIC THRESHOLD AND THRESHOLD OF OCTAVE MASKING

JAGADISH A.

The value of the test battery approach in assessing human auditory function has been recognized for many years and may prove a more reliable approach to susceptibility testing. If several correlates were identified, they could be used as a test battery for susceptibility to noise-induced hearing loss. Psycho-acoustic tasks could be used as a new indices of susceptibility to noise-induced hearing loss, replacing traditional TTS-based susceptibility tests. The identification of psychoacoustic correlates of TTS may also provide new information about the areas of the auditory system involved in the fatigue process and it may also be useful in detecting minimal auditory dysfunction. (Eldrege and Miller 1969, Ward and Durall 1971, Lipscomb, 1975).

Individual differences for susceptibility to TTS and PTS was known since 1830**.** Some investigators have studied possible relationships between susceptibility to TTS and other psycho-acoustic tasks. Lawrence and Blanchard (1959), suggested that a psycho-acoustic measures of cochlear non-linearity, the aural overload test, might be a correlate of susceptibility to auditory fatigue. Grimm and Bess (1973), suggested Threshold of Octave Masking (TOM) test, which is a tonal masking technique used to estimate the threshold of cochlear distoration or non-linearity as a substitute test for measuring aural harmonic thresholds. Clack and Bess (1969), Grimm and Bess (1973), and Nelson and Bilger (1974), have found close agreement between TOM and threshold of aural overload tests.

Humes, Schwatz and Bess (1977) found the relationship between TOM and TTS. There was a negative correlation between TOM and TTS. They strongly recommended TOM tests as a well-suited test for susceptibility.

Borg (1968), Brasher *et al.* (1969), Coles (1969), Zakrisson and Borg (1974), Zakrisson *et al.* (1975), reported the influence of the acoustic reflex (AR) on TTS.

The relation between TTS and ART exists because when reflex occurs there will be attenuation of low frequency sounds reaching the cochlea. As TTS is related to the intensity of the signal reaching the cochlea, the reduction in the intensity of the signal brought about by reflex action can be expected to result in less TTS. On the basis of TTS, many tests have been developed to identify subjects who are susceptible to noise-induced hearing loss or PTS.

Johnson *et al.*.(1967), Miyakita *et al.* (1978), have found relationship between the acoustic reflex threshold and susceptibility to noise-induced hearing loss or PTS. Anne Zachariah (1980), has found that the subjects who show greater TTS exhibits low acoustic reflex threshold and that subjects who show less temporary threshold exhibit high reflex thresholds. It is also reported that the subjects with low acoustic reflex threshold (tender ear) show greater TTS and greater magnitude of contraction of the stapedius muscle through the acoustic reflex and that subjects who exhibit high reflex threshold (tough ears) show less TTS and less magnitude of contraction of stapedius muscle.

There are studies regarding the relationship between TOM and TT8 (Humes *et al*., 1977) and ART and TTS (Anne Zachariah, 1980). The present study was undertaken to find out the relationship between TOM values and ART.

Thirty normal hearing subjects in the age range of 16 to 26 years were selected for this study. Only one ear of the subject was selected. Selection of the ear (right or left) was done randomly.

The experiment was carried out in sound treated rooms at the Audiology Department of the All India Institute of Speech and Hearing, Mysore. The ambient noise levels were below the proposed maximum allowable noise levels (Hirschorn, 1971).

The study consisted of two parts.

Part 1: In this part, TOM values for 1 KHz and 2 KHz were found. Beltone 200-C dual channel clinical audiometer was used for this purpose.

Threshold for pulsed 1000 Hz(f_2) tone in quiet was obtained. Later, 500 Hz(f_a) tone was introduced into the same ear. Intensity of f_1 (500 Hz) was increased in 5dB steps, until the pulsed tone was masked. Next, intensities of f_1 (500 Hz) tone required to mask the pulsed tone presented at l0dB SL, 15 dB SL and 20 dB SL were determined and corresponding shifts were noted. Similarly threshold for pulsed 2000 Hz (f_2)in quiet was determined and a continuous 1000 Hz (f_1) tone was introduced to the same ear and corresponding shifts were noted as above. The threshold of octave masking (TOM) was calculated by plotting the threshold shifts f_2(1000 Hz and 2000 Hz). A line of best fit was drawn through the data points representing lOdB and 15dB and 20dB threshold shifts. The function was extended to intercept the f_1 intensity level axis. The point of intercept was considered Threshold of Octave Masking (TOM). Thus, TOM values for 1 KHz and 2 KHz were determined using slope extrapolation method.

Part 2: (a) To measure ART ZO 73 impedance bridge was used. Impedance bridge was checked for calibration. Earphone was placed on the ear for which TOM values were found. Probe tip was inserted to the opposite ear with a suitable eartip and air-tight sealing was obtained. Middle ear pressure was determined, i.e., the pressure at which there was maximum compliance was seen.

Frequency knob was set to 500 Hz and intensity knob was set at comfortable level and the presentation button was gently pressed. Minimum intensity of the

Stimulus which produced noticeable deflection of the meter needle was noted and this level was, recorded as ART. Similarly, acoustic reflex thresholds at 1000 Hz and 2000Hz were measured.

(b) *To measure the magnitude of reflex*

Same procedure in part II (a) was followed upto getting middle ear pressure. Next step was to set the frequency knob to 500 Hz and the intensity knob was adjusted to l0dB above the ART value. The compliance scale was manipulated in such a way the balance meter read ' I' (lower scale of the Balance meter). Then the presentation button was gently pressed and corresponding deflection in the balance meter was recorded using the above procedure, magnitude of reflex was determined at 20 dB above ART for 500 Hz tone.

Similarly, magnitude of reflex was determined for 1 KHz and 2 KHz tones at 10 dB and 20 dB above ART. All subjects were tested in the same manner.

To find out the intra-subject reliability a sample of 10 subjects randomly selected from the total group was re-tested using the same procedure mentioned above. The data were analysed statistically.

The following conclusions are made from the study :

1. There is significant correlation between ART at 1 KHz and TOM at 1 KHz.
2. There exists a good correlation between ART at 2 KHz and TOM at 2 KHz.
3. It appears that the relationship between TOM and ART is frequency-dependent.
4. Subjects who show lower ART exhibit low TOM values and subjects who show higher ART exhibit higher TOM values.
5. There exists a negative correlation between ART and magnitude of reflex.
6. Subjects who show lower ART and lower TOM yield larger magnitude of reflex.
7. Subjects who show higher ART and highest TOM yield smaller magnitude of reflex.
8. On the whole, the analysis of the data reveals that subjects with lower TOM have lower ART and higher magnitude or reflex. Lower TOM lower ART and higher magnitude of reflex may be suggestive of susceptibility to noise-induced hearing.
9. ART and magnitude of reflex thresholds being more objective tests, these can be employed in finding out the subjects who are susceptible to NIHL.

Limitation of the study

The inherent limitation of susceptibility tests applies to this study also.

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