A Study of the Relationship Between "Fatigability of Acoustic Reflex" and Temporary Threshold Shift*

KAMAKSHI

It has been generally recognized that there are individual differences in the susceptibility of ears to damage from noise. Many references have been made in the literature to 'tough ears' and 'tender ears' referring to differences in degree of susceptibility. Because of the recognition of individual differences in susceptibility, considerable attention has been focussed on the problem of identifying those individuals who, when placed in a noisy working environment, would be most susceptible to NIHL. The assumption is that if such individuals could be identified, they could be assigned to less noisy working environments, or at least could be provided with the best possible ear protection when they are working in noisy environment. Attempts have been made to devise tests for susceptibility that could be administered at the time the reference audiogram is obtained. Much of the susceptibility tests are based on the TTS paradigm. The rationale for using TTS was based on a hypothesis put forth by Temkin.

Temkin suggested that the measurement of temporary change in hearing sensitivity following a brief and moderately intense acoustic overstimulation provided a simple and valid estimate of eventual permanent threshold shift incurred from more severe exposures to loud sounds.

Attempts have been made to use acoustic reflex threshold as a probable indicator of subjects susceptibility to NIHL.

Anne Zachariah (1980) studied the relationship between Temporary Threshold Shift and Acoustic Reflex Threshold in a normal hearing population with regard to the subjects susceptibility to NIHL. Her results indicate that subjects who show greater TTS have lower acoustic reflex thresholds and the subjects who show less TTS have higher acoustic reflex thresholds. This study attempts to find the relationship between "Fatigability of the acoustic reflex" and TTS.

There are two experiments :

(1) The first experiment dealt with the measurement of "Fatigability of reflex" using Impedance Bridge. In brief, the procedure was as follows :

Determining reflex threshold of right ear at 2 KHz (this reflex threshold was labelled as ART_1). fatiguing

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right ear by presenting 2 KHz tone continuously for 3 minutes at 110 dB SPL and measuring the reflex threshold at 2 KHz in the right ear immediately after the ear was fatigued. (This reflex threshold was labelled as ART_2.)

(*Note*: While finding ART_2 care has been taken to see that the deflection of balance meter needle was same as observed in ART_1.) The difference between ART_2 and ART_1 was called "Fatigability of reflex". When the ear was fatigued for 3 minutes, balance meter needle position was observed to see whether the needle returned to '0' position of the balance meter within 3 minutes. This information was also collected for each subject.

(2) The second experiment dealt with the measurement of TTS_2. The subject's right ear was fatigued by a 2 KHz tone at 110 dB SPL for 10 minutes continuously. The TTS was determined at 4 KHz after 2 minutes of recovery period (TTS_2). 50 adult normal hearing subjects (30 females and 20 males) were tested.

10 subjects (5 males and 5 females) were randomly selected and were retested in the similar way as mentioned above for test–retest reliability.

The data collected were analysed using appropriate statistical methods. Graphically analysis was given due consideration since it provided a better representation and understanding of this study.

Conclusions

The following conclusions can be drawn from the present study :

(1) There exists a significant correlation between the "Fatigability of reflex" and TTS.

(2) Subjects exhibiting greater TTS showed greater "Fatigability of reflex" and subjects exhibiting less TTS showed less "Fatigability of reflex".

(3) There is no significant difference between males and females with regard to TTS.

(4) There is no significant difference between males and females with regard to "Fatigability of reflex".

(5) "Fatigability of reflex" can be used as a possible predictor of subjects' susceptibility to noise-induced hearing loss.

(6) Subjects who showed greater TTS exhibited decay of acoustic reflex within 3 minutes.

(7) Subjects who showed greater "Fatigability of reflex" exhibited decay of acoustic reflex within 3 minutes.

(8) It is observed that the same subjects who exhibited greater TTS and greater "Fatigability of reflex" also showed decay of acoustic reflex within 3 minutes.

Thus it can be concluded that greater TTS; "Fatigability of reflex"; and "decay of acoustic reflex within 3 minutes" go together.

Implications of the Study

(1) Fatigability of reflex" test can be used as an objective test to detect subjects who are susceptible to NIHL.

(2) This test can be easily and quickly administered.

Limitations

(1) Size of the sample was limited to 50 subjects.

(2) All the subjects were adults and they belonged to the staff and student population of All India Institute of Speech and Hearing which may not be the true representative sample of the universe of normal hearing population.

(3) Limitations inherent in measures of TTS as indices of susceptibility to NIHL are also limitations of this study.

Recommendations

(1) Relationship between "Fatigability of Reflex" and TTS may be studied on a large sample.

(2) "Fatigability of reflex" may be studied in industrial workers who have and who have not developed hearing loss due to noise exposure.

(3) "Fatigability of reflex" can be studied in subjects belonging to different age groups, to account for ageing factor in "Fatigability of reflex".

(4) Relationship between reflex decay and "Fatigability of reflex" may also be established by testing a large sample.

(5) By testing a large sample of subjects, it is worthwhile to establish firmly, the tentative conclusion of the present study that "Fatigability of reflex", TTS, reflex decay and susceptibility to noise-induced hearing loss—all these are related.