

An Objective Method of Determining Recovery Period and Asymptotic Period from Loudness Adaptation *

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This study deals with a new objective method of measuring recovery from loudness adaptation (objective residual monaural loudness adaptation) and also asymptotic period of loudness adaptation in normal hearing subjects using Hadsen (7,072) electro-acoustic impedance bridge. Three experiments were carried out. In brief, Experiment I was to determine recovery time at the adapting frequencies 500, 1,000 and 2,000 Hz. The ear was adapted for 3 minutes at 20 dB above acoustic reflex threshold of the normal hearing subjects at one of the frequencies 500 Hz to 1,000 Hz or 2,000 Hz. Recovery time was measured at the adapted frequency. Minimum of two subjects were tested at each frequency and ten more subjects were tested at 2,000 Hz. The same experiment was repeated on different days to check the reliability of the results with a minimum of 24 to 48 hours of rest periods. The recovery time among individuals was found to be varied. On the basis of these results, the second experiment was conducted.

In Experiment II, recovery time was determined at one octave higher than the adapting frequency. Minimum of two subjects were chosen to measure recovery time

at octave frequencies 1,000 Hz, 2,000 Hz and 4,000 Hz. One of the ears was adapted for 3 minutes at 20 dB above ART threshold of the normal hearing subject and recovery time was measured at one octave higher than the adapted frequency, viz., 1,000 Hz or 2,000 Hz or 4,000 Hz. The results showed that recovery time increased progressively from 1,000 Hz to 4,000 Hz, adaptation being more at a frequency one octave higher than the adapting frequency.

Experiment III was conducted to determine asymptotic state of adaptation on the basis of recovery time. Five subjects were tested for this experiment. One of the ears was adapted for 1,000 Hz tone for different durations of exposure (3 min., 5 min., 7 min., 9 min., 11 min. and 13 min.) at or ± 5 dB above acoustic reflex threshold. A minimum of fifteen sessions were required to complete the experiment for each subject with a minimum rest period of 24 to 48 hours. The same experiment was repeated twice to check the reliability. Results of this experiment indicated that this method could be used effectively for determining asymptotic period for loudness adaptation.

Conclusions

- (1) Recovery time and asymptotic state of adaptation can be measured objectively using this method.

* Master's Dissertation, University of Mysore, 1977.

- (2) Recovery time at one octave higher than the adapting frequency is more when measured at the adapting frequency. This leads to the conclusion that adaptation is more at a frequency one octave higher than the adapting frequency. (Here, in this study it is assumed that greater the recovery time greater would be the adaptation.)
- (3) Adaptation (objective residual monaural loudness adaptation) reached asymptotic state at about 7 minutes when the adapting level was at or ± 5 dB acoustic reflex threshold of the normal hearing subjects.

Recommendations

- (1) It would be necessary to find relation between loudness adaptation and

recovery from loudness adaptation in a large number of normal hearing subjects using the present objective method.

- (2) As the present study has demonstrated that in one of the subjects there was decrease in recovery time with increase in the duration of exposure to adapting stimulus, further research on this aspect is needed.
- (3) Contrary to earlier reports, the present study has indicated that the adaptation at a frequency one octave higher than the adapting frequency is more. This needs further investigation.
- (4) As this method is an objective method, its use on clinical population is worth consideration.