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Prediction of a Relationship Between Behavioural Threshold, Acoustic Reflex Threshold and Loudness Discomfort Level

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The current study was carried out to explore and predict the relationship between three audiological measures viz. Behavioural Threshold Acoustic Reflex Threshold (ART) and Loudness Discomfort Level (LDL) in normal and sensorineural hearing impaired listeners.

Twenty normal hearing ears and twenty sensorineural ears were tested at foour frequencies-500Hz, 1KHz, 2KHz, and 4KHz. Behavioural Threshold was determined using the Modified Hughson-Westlake Procedure and loudness discomfort level (LDL) was determined using the psychophysical method of limits on a diagnostic GSI-16 audiometer acoustic reflex threshold was obtained at the above four test frequencies using the contralateral automatic tympanogram and reflex (T & R) mode of an immittance audiometer Madsen ZO-174.

Statistical analysis of the above data was carried out using a statistical software program (Number Cruncher statistical system or NCSS) on a Wipro P.C. system.

The following conclusions may be drawn from this study:

1. There exist statistically significant differences between groups (normal and SN loss) and between measures (behavioural threshold, ART and LDL) at all frequencies.
2. There exist statistically significant differences between the different degrees of severity of hearing loss (mild, moderate, moderately-severe and severe) and between measures within the SN hearing impaired group.
3. There exist no statistically significant differences between the acoustic reflex thresholds (ARTs) of the normal and SN hearing impaired groups.
4. There exist no statistically significant differences between the loudness discomfort. levels (LDLs) of the two groups, though mean data indicate lower LDLs for the hearing impaired group.
5. There exist statistically significant difference between the acoustic reflex threshold (ART) and loudness discomfort level (LDL) measures for each of the normal hearing and SN hearing impaired groups.
6. Presence of hearing loss on the average shifts the loudness discomfort level more than the acoustic reflex threshold.
7. There exist significant correlations between behavioural threshold and acoustic reflex threshold (ART) at 500Hz and 1KHz but not at 2 KHz and 4 KHz. The regression equation obtained to estimate the behavioural threshold of an individual from ART at 500Hz and 1KHz are

500Hz: Htm = 1.28^-67.85 Htm: Behaviur a threshold of hearing impaired.
lOOOHz: Hz = 0.67Hart - 7.27 Hart: ART of hearing impaired.

At 2000Hz and 4000Hz the regression equations do not have predictive validity.

8. There exist significant correlations between the loudness discomfort level (LDL) and acoustic reflex threshold (ART) at 500Hz and 1KHz but not at 2KHz and 4KHz.

The regression equation obtained to estimate the loudness discomfort level of SN hearing impaired individual are:

500Hz : $H_{LDL} = 0.27\ HART + 79.46$

lOOOHz : $H_{LDL} = 0.27\ HART + 81.24$

At 2000 Hz and 4000Hz, the regression equations do not have predictive validity.

9. Predictive accuracy of the regression equations to estimate behavioural threshold from acoustic reflex threshold using a ± lOdB criterion is found to be only 60% and 50% respectively at 500Hz and lOOOHz.

10. Predictive accuracy of the regression equation to estimate the loudness discomfort level (LDL) from acoustic reflex threshold using a ± lOdB criterion is found to be satisfactory (75% and 80% respectively at 500Hz and lOOOHz)

Limitations:

1. The predictive validity of the regression equation is restricted to 500Hz. Hence implications regarding the amount of hearing loss and required amplification at higher frequencies cannot be drawn.

2. Since only forty ears were tested, there is need to include a greater number of subjects.

3. The predictive accuracy of the regression equations is established for adults and hence needs to be validated for a population of children.

4. A significant amount of individual variability exists among data and so information from a battery of available tests is to be weighted carefully.

5. Presence of acoustic reflex threshold is mandatory in order to obtain estimates of behavioural threshold and loudness discomfort level. Hence profound losses are not inclusive in this category.