
A&E LOUDNESS SCALING TEST: SHORTENED VERSION

Introduction

The A&E Loudness Scaling (LS) test is a typical measurement of the loudness growth function. The test presents 1/3 octave narrowband noise at a specific centre frequency and at different intensities. The listener is asked to rate the perceived loudness on a 7-point visual-analogue scale. The centre frequencies used to date are 250, 1000, and 4000 Hz. The test is considered useful when programming a hearing aid or cochlear implant.

The original test presents the sounds with a 5 dB interval between two threshold values (e.g., 30-85 dB). For interpretation, clinicians reduce these many scores to only 4, being the averages of three adjacent scores at centre intensities 35 - 50 - 75 - 80 dB. Therefore it seemed useful to shorten the test by testing only those centre intensities. The goal of this study was to validate the clinical efficacy of the shortened **A&E LS** test compared to the traditional test procedure.

A&E LS test traditional procedure

For each test frequency, narrowband noise is presented twice at 12 presentation levels (all 5 dB steps from 30 to 85 dB). This means 24 stimulations per test frequency.

A&E LS test shortened procedure

In the Short Test mode the stimuli are presented three times at 35, 50, 65, and 80 dB, hence only 12 stimulations per test frequency.

Materials and Methods

Subjects entry criteria

The validation was performed on 35 CI recipients. All subjects were at least 16 years of age and willing and able to:

- Perform a psychoacoustic test twice,
- Able to read and interpret detailed instructions.

Test procedure

The LS test was performed twice on all test frequencies, once with the original and once with the shortened version. The first version used was randomly determined. The tests were performed in free field with AudiQueen psychoacoustic test suite (Otoconsult NV, Antwerp, Belgium).

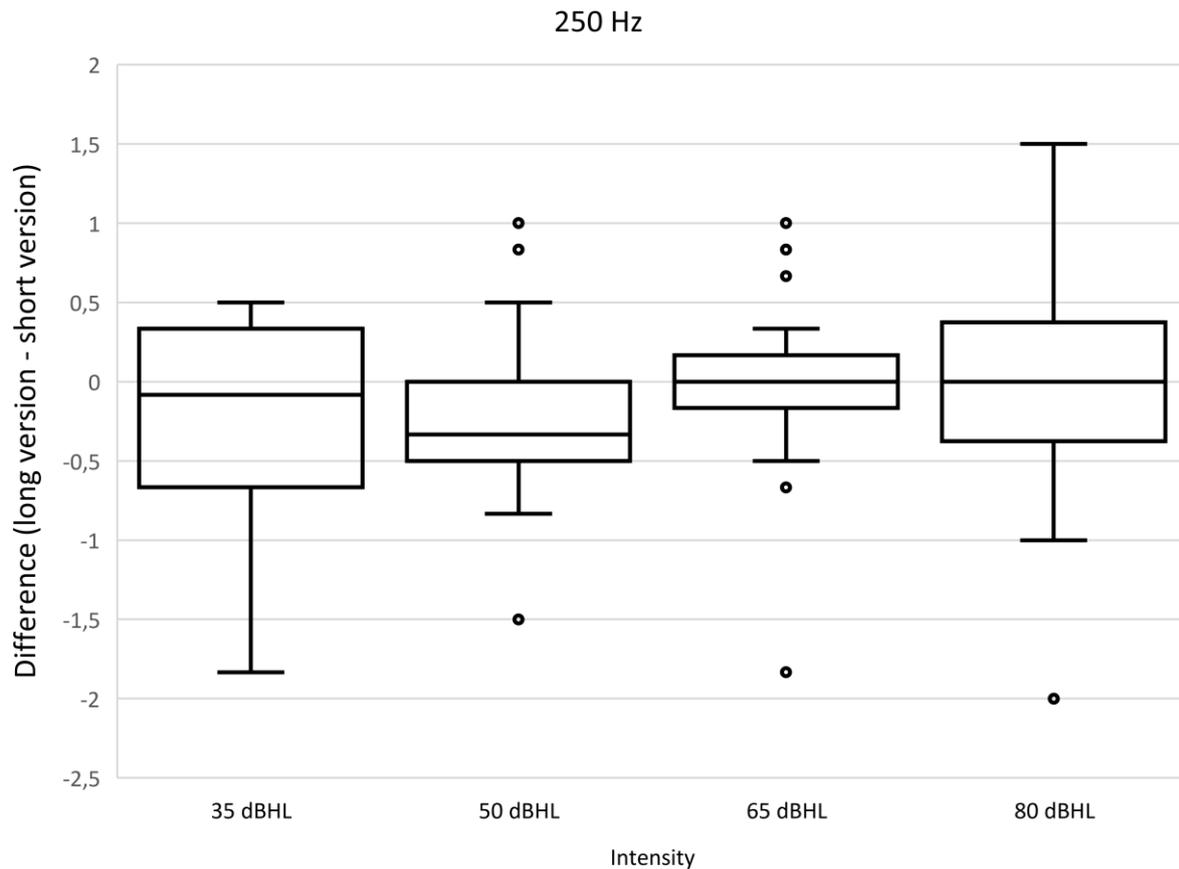
Statistics

The scores with the original version were recalculated into one score each for 35, 50, 75 and 80 dB, where each score was the average of three adjacent scores around these intensities. For example, the 35 dB score was the average of the 30, 35 and 40 dB scores, and so on.

We then compared the recalculated original scores with the short-test scores. For this, nonparametric statistics were used with box and whisker plots for the median, lower, and upper quartiles and extremes) for descriptive statistics (Tukey JW 1977, Hollander M 1999) and the Wilcoxon signed-rank test to analyse within-subject differences.

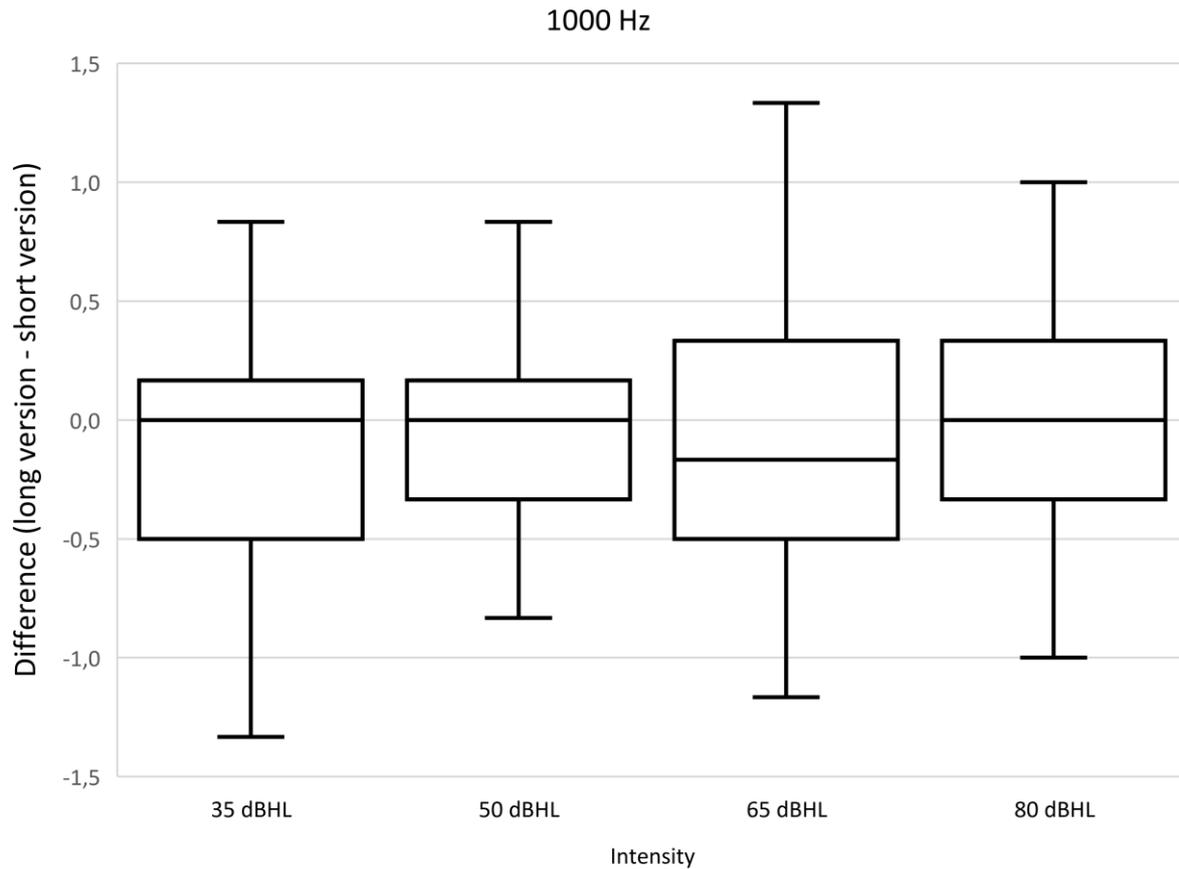
Results

These were the within-subject differences between the original and the shortened A&E LS testing (Traditional – shortened) at each frequency and intensity.



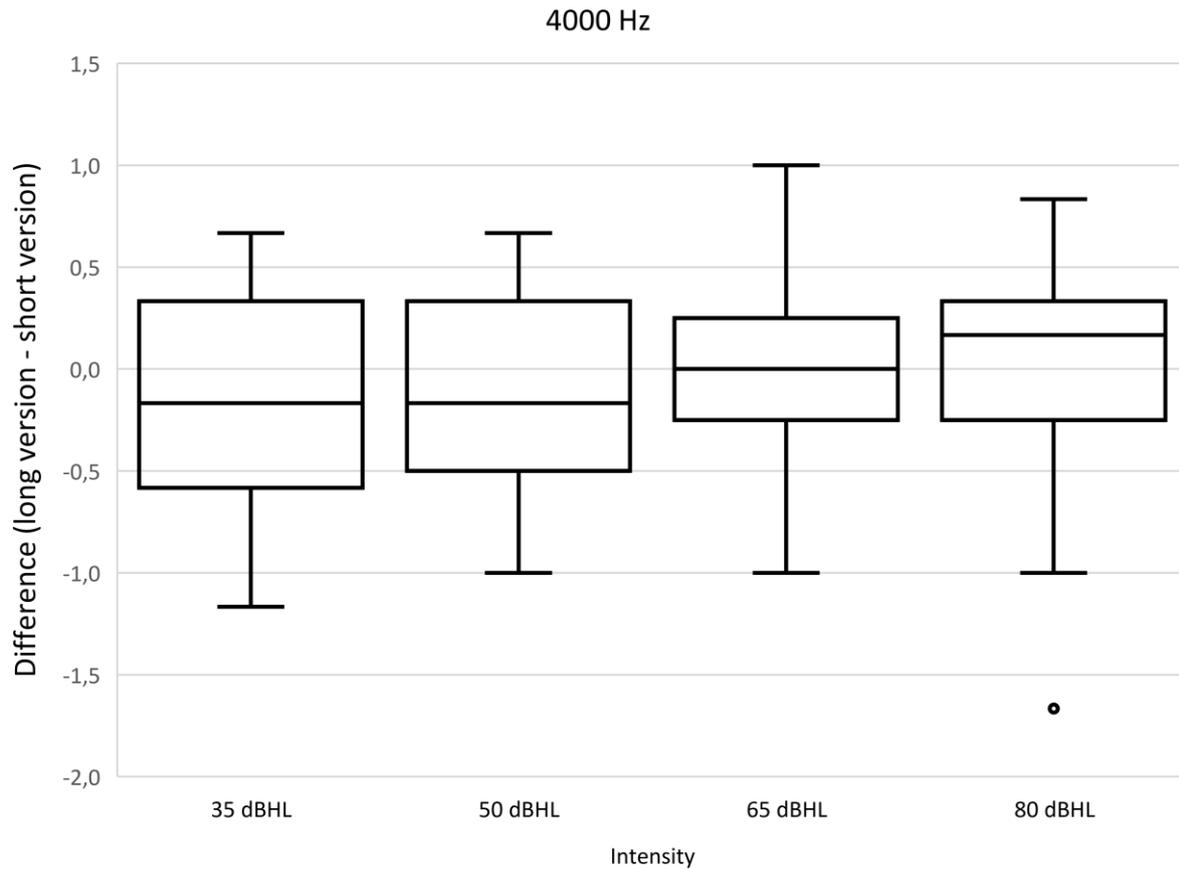
	35 dB	50 dB	65 dB	80 dB
# cases	32	32	32	32
Max	0.5	1	1	1.5
P75	0.3	0	0.2	0.4
P50	-0.1	-0.3	0	0
P25	-0.7	-0.5	-0.2	-0.4
Min	-1.8	-1.5	-1.8	-2
Wilcoxon p-value	0.13	0.11	0.94	0.83

250 Hz: the graph shows the within-patient differences between the original and the short test results (box and whisker plots). The table shows the values of the five parameters per presentation level.



	35 dB	50 dB	65 dB	80 dB
# cases	31	31	31	31
Max	0.8	0.8	1.3	1
P75	0.2	0.2	0.3	0.3
P50	0	0	-0.2	0
P25	-0.5	-0.3	-0.5	-0.3
Min	-1.3	-0.8	-1.2	-1
Wilcoxon p-value	0.27	0.54	0.4	0.54

1000 Hz: the graph shows the within-patient differences between the original and the short test results (box and whisker plots). The table shows the values of the five parameters per presentation level.



	35 dB	50 dB	65 dB	80 dB
# cases	33	33	33	33
Max	0.7	0.7	1	0.8
P75	0.3	0.3	0.3	0.3
P50	-0.2	-0.2	0	0.2
P25	-0.6	-0.5	-0.3	-0.3
P25	-0.6	-0.5	-0.3	-0.3
Min	-1.2	-1	-1	-1.7
Wilcoxon p-value	0.1	0.3	0.85	0.36

4000 Hz: the graph shows the within-patient differences between the original and the short test results (box and whisker plots). The table shows the values of the five parameters per presentation level.

Discussion

Across all frequencies and intensities, most median within-subject differences were zero and all those values lied between -0.3 and 0. Furthermore, within-subject statistical comparisons, namely the Wilcoxon signed-rank test, denoted that there is no significant difference between the traditional and shortened procedures of the AŞE LS.

Conclusion

The test results of the shortend loudness scaling test at 35, 50, 65 and 80 dB are equal to those of the original test as obtained by averaging 3 consecutive intensities at the same centre intensities for subjects with a CI. It can be concluded that the shortened procedure is clinically equivalent to the traditional procedure of the AŞE LS test.

References

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