Benefit from patient's own and virtual hearing aids in different acoustic conditions

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Background, Improving speech intelligibility is the main aim of the hearing aid fitting procedure. However, this process is very complex and influenced by many subjective factors like the experience of the hearing aid (HA) acoustician. What is more, in many countries the hearing devices benefit measurement remains ambiguous or not standardized at all.

Here an internationally applicable approach is suggested and tested involving assessment of speech recognition not only with own HA but also with virtual, well-controlled   hearing aid software implemented in Master Hearing Aid (MHA). The MHA acts as a supporting tool and indicates a minimum benefit that should be obtained with the subject's own HAs.

Material and Methods, 20 listeners with a sensorineural hearing loss (median 48.1 dB HL) and at least 3-year lasting HA experience participated in the research. Speech reception thresholds (SRT, 50% correct responses) were obtained adaptively with the Polish Matrix Test including unaided and aided measurements. Aided conditions consisted of measurements included participants' HAs and the MHA. SRT was measured in quiet and different masking scenarios including: test-specific stationary noise (TSN), modulated noise ICRA5-250, and realistic noise of cafeteria ambience.

Results, Unaided SRTs in masking conditions cannot be accurately predicted by average hearing threshold only, in contrast to SRTs measured in quiet ($R2=0.71$). SRTs across masking conditions are well correlated with each other (TSN and cafeteria $R2=0.78$, TSN and ICRA5-250 $R2=0.92$), which suggest a common suprathreshold deficit contributing and affecting speech recognition in noise.

Benefit from HAs is higher for MHA than for HAs in all measurement conditions. The biggest difference is observed for ICRA5-250 noise (median of 2.5 and 10.0 dB for HAs and MHA, respectively). For both, own HAs and MHA, the benefits in TSN correlate with the benefits in ICRA5-250 ($R2=0.61$). The benefits in the cafeteria noise are significantly smaller (median of 0.6 dB) than in laboratory scenes and do not correlate with them ($R2<0.02$).

Conclusions, Gathered data indicate a necessity of the aided speech recognition not only in laboratory conditions but also in more complex acoustic environments representing everyday communication situations. What is more, speech recognition without HAs in acoustically complex paradigm can be predicted using the results obtained in controlled laboratory conditions. However, this does not hold for assessment of benefit from HAs. The measurements with MHA can act as a supporting tool in HA fitting and lead to optimized patients' speech recognition with their own HAs.