Performance benefits for adults using a cochlear implant with adaptive dynamic range optimization (ADRO): a comparative study.

The aim of this study was to assess the qualitative and quantitative benefits for speech-recognition ability of a preprocessing strategy known as adaptive dynamic range optimization (ADRO), used in conjunction with the subject's standard MAP, in comparison with the subject's standard MAP alone, for a group of experienced German-speaking adults using the Nucleus 24 Cochlear implant. In a prospective, single-subject, comparative study design, experienced adult CI-users were asked to trial and compare both their standard MAP and the newly fitted ADRO MAP (ADRO MAP fitting - week 0) following a take-home trial period of 5 weeks. Assessment of speech recognition ability performed in quiet (at 50, 60 and 70 dB SPL) and adaptively in noise was carried out repeatedly in two test sessions in weeks 5 and 7 (ADRO MAP postfitting) using both MAPs. The order of speech tests and MAPs tested was counterbalanced across the test sessions to control for potential learning effects during the study. Subjective assessments were performed at week 0 to assess details of current usage. Comparative subjective assessments were carried out at weeks 5 and 7 to obtain impressions of loudness of environmental sounds and speech understanding in a variety of conversational situations with both MAPs and finally MAP preference judgements. Fifteen adult,
German-speaking, experienced implant users wearing their body-worn SPrint processor for a minimum of six hours and up to 16 hours per day were enrolled in the study across three university clinic hospitals in Germany. On average, speech-reception thresholds (SRT) were significantly improved with the ADRO MAP compared to using the standard MAP for all speech materials in quiet. The mean advantage for SRT values with the ADRO MAP was 2.9 dB, sigma +/- 2.8 dB (p = 0.002) for the Freiburger Numbers test and 3.3 dB, sigma +/- 3.2 dB (p = 0.008) for the Freiburger Monosyllabic Words test. In noise, the ADRO MAP led to a significant improvement for the group for the mean signal-to-noise ratio required for a 50% speech recognition score (SNR 50) for the Oldenburger sentences of 1.74 dB, sigma +/- 3.2 dB (p = 0.048). Comparison of subjective impressions of loudness of environmental sounds revealed no significant difference in the ratings observed with either MAP. For speech understanding in a variety of listening situations, 35% of subjects preferred the ADRO MAP, 29% preferred the standard MAP whereas 36% reported no difference. Statistically the MAP preferences for the groups were not significant, however a significant MAP preference was noted in four subjects for the ADRO MAP and in two subjects for the standard MAP. Our study results demonstrate significant benefits of ADRO for speech recognition ability in quiet and in noise for both soft and conversational levels of speech. For the majority of subjects, both the ADRO and standard MAPs were found to be useful on a daily basis. No reductions in performance were noted for speech recognition or loudness scaling judgements of environmental sounds when using the newly fitted ADRO MAP, suggesting a smooth transition to the use of the preprocessing algorithm. It is recommended that an ADRO MAP be provided for all CI users as an additional program option to offer potential added benefit in select environments.