MULTICENTRIC FIELD EVALUATION OF A NEW SPECTRAL PEAK CODING STRATEGY WITH NATIVE GERMAN SPEAKING COCHLEAR IMPLANT USERS

N. Dillier[1], R.D. Battmer[2], W. Döring[3], J. Müller-Deile[4]

[1] ENT-Department, University Hospital, CH-8091 Zürich, Switzerland
[2] HNO-Klinik der Medizinischen Hochschule Hannover, Karl Wiechert-Allee 9, D-30623 Hannover, Germany
[3] Abteilung HNO, Klinik der RWTH, Pauwelsstr. 30, D-52057 Aachen, Germany
[4] HNO-Klinik der Universität, Arnold-Heller-Str. 14, D-24105 Kiel 1, Germany

In a multicentric study involving 5 European cochlear implant clinics the speech perception abilities of individuals implanted with the Nucleus 22 Channel Cochlear Implant System were investigated, when using a new spectral peak (SPEAK) speech encoding strategy. This strategy continuously analyzes the speech signal using 20 digital programmable bandpass filters and presents up to ten spectral maxima to the implanted electrodes. The electronic circuitry for the new encoder was embedded in a body-worn processor case identical to the Nucleus Miniature Speech Processor (MSP).

Results for 17 native German speaking cochlear implant users will be presented in this paper whereas the results for the native English speaking implantees will be reported separately. Each subject's performance with the experimental encoder (SPEAK) was evaluated relative to his or her performance in a baseline condition, on a variety of auditory perceptual tasks. Baseline levels of auditory performance were established using the Multipeak (MPEAK) speech processing strategy of the MSP.

All subjects received both the baseline (MPEAK) and experimental (SPEAK) conditions twice, in an A-B-A-B paradigm over a 12 week period. Questionnaires were used to assess musical quality, effects on tinnitus and subjective impressions. Vowel, consonant and monosyllable word tests as well as two different sentence tests in quiet and noise were done at each experimental session. Significant improvements in speech perception were noted for most subjects on at least one measure when using the SPEAK strategy. Largest overall improvements were observed for the sentence tests in noisy conditions.

General summary of statistical analysis so far, with a total of 17 subjects from 4 different centers.

The analysis has been conducted twice: the first time with all 17 subjects, the second time with subject ut (Zürich) excluded with a filter function (FREIB-Test-Results must be above 10 % to include subject in study). Only the analyses with the activated filter function are summarized below.

The statistical package SPSS for Windows has been used to carry out these analyses. Printouts are attached.

The following analyses have been conducted: summary descriptive statistics for all variables (Mean, StdDev, Variance, Minimum, Maximum) overall and sorted by processor type.
As the descriptive analysis revealed possible biases for the variable CLINIC the statistics were calculated for subpopulations by levels of clinic, processor and session.

T-Tests were conducted for the variable PROCESSOR which are summarized below:

Subtest	*Difference (SPEAK-MSP)*	*2 tail significance*
Vowels	.02	.994
Consonants	6.9	.157
PlaceFeat.	12.8	.079
FreibWords	8.0	.091
InnsQuiet	11.7	.000 ***
Inns15dB	37.9	.001 **
Inns10dB	28.4	.000 ***
Inns5dB	28.9	.001 **
InnsLessNoise	27.0	.000 ***
InnsMoreNoise	33.2	.000 ***
GöttQuiet	7.5	.275
Gött15dB	12.3	.073
Gött10dB	11.9	.093
Gött5dB	26.7	.002 **
GöttLessNoise	14.3	.023 *
GöttMoreNoise	15.4	.001 **

Note: all differences were positive, i.e. the mean results with SPEAK were all higher than with MSP, although the differences were only statistically significant for the Innsbruck sentence tests and the Göttinger sentence tests in noise.

A simple factorial Analysis of Variance was conducted for all subtests with 3 independent factors: (i) Clinic (Aachen, Hannover, Kiel, Zürich), (ii) Strategy/Processor Type (MPEAK/MSP or SPEAK/Spectra), (iii) Phase or Session (1st test or 2nd test)

	Significance of F		
	Clinic	Processor	Session
Vowels	.000	.734	.157

Consonants	.000	.151	.263
FreibWords	.000	.057	.294
InnsQuiet	.004	.000	.162
Inns10dB	.002	.000	.643
Inns5dB	.040	.001	.659
InnsLessNoise	.001	.000	.975
InnsMoreNoise	.002	.000	.350
GöttQuiet	.000	.153	.966
Gött15dB	.031	.117	.760
Gött10dB	.000	.047	.548
Gött5dB	.055	.012	.244
GöttLessNoise	.000	.008	.733
GöttMoreNoise	.000	.000	.051

Note: The effect of the factor CLINIC turned out to be rather strong and decisive for the variance in the Consonant, Vowel, Freiburg Monosyllable and Göttingen Test in quiet and less noise. The PROCESSOR factor was accounting for significant amounts of the variance for the Innsbruck sentence tests (all conditions) and the Göttingen-Sentence test in the most unfavourable noise condition. The Session effect seemed to be negligible.

Musical Instrument Identification, Music Rating Scale, Performance Rating, Tinnitus Questionnaire as well as anecdotal comments have not been fully analyzed yet.