

Initial Experience with Electrocochleography Used in Clinical Routine: Correlations with Speech Perception Outcomes in Adults

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Introduction

Electrocochleography (ECoChG) has received increased interest in the recent years, especially during cochlear implant (CI) electrode insertion and postoperative predictions of outcome. The Advanced Bionics (AB) system is capable of measuring ECoChGs via the intra-cochlear electrode array for an acoustically delivered low-frequency sinusoidal stimulus. This information is used as feedback to the surgeon during insertion of the electrode array. Furthermore, these measurements can be performed post-operatively.

Material and Methods

ECoChG signals in 10 subjects with residual hearing receiving either the AB HiResUltra SlimJ or Mid-Scala electrode arrays was measured during insertion. After complete insertion, ECoChG responses to tone bursts at 125, 250, 500, 1 kHz and 2 kHz were recorded and an assumption of threshold was made via an implemented algorithm. The threshold estimation procedure was repeated at 1, 3 & 6 months post activation.

Nr	Gender	Age	Low Freq residual hearing in CI ear	Contralateral ear	Implant & Electrode	
1	CA	F	57	(yes) Mod-sev	No auditory nerve	HiRes Ultra MS
2	MM1	F	17	No	HA Mod-Sev SNHL	HiRes Ultra MS
3	MM2	F	62	No	HA Mild-Mod SNHL	HiRes Ultra MS
4	MW	M	40	(yes) Mod-Sev	HA Sev SNHL	HiRes Ultra MS
5	SN	M	77	yes	HA Mild-mod sloping SNHL	HiRes Ultra SlimJ
6	MK	M	62	yes	Normal Hearing	HiRes Ultra SlimJ
7	MA	M	80	yes	HA Sev SNHL	HiRes Ultra SlimJ
8	RE	M	81	yes	HA Mod-Sev SNHL	HiRes Ultra SlimJ
9	RH	M	78	yes	HA Mod-Sev SNHL	HiRes Ultra SlimJ
10	NE	M	86	(yes)	HA Sev SNHL	HiRes Ultra SlimJ

Tab I. Overview of patients

Results

Feasibility of ECoChG Measurements

Nr	Complications during surgery	INTRA-OP measurements	POST-OP measurements @1 Month	POST-OP measurements @3 Month	POST-OP measurements @6 Month
1	CA	Tip fold over	yes	no	no
2	MM1	None	no	no	no
3	MM2	Ear tip removed	no	no	no
4	MW	None	yes	no	no
5	SN	None	yes	yes	yes
6	MK	+ Saccotomy	no	no	no
7	MA	None	no	no	no
8	RE	None	yes	yes	yes
9	RH	None	yes	yes	NT
10	NE	Software Problems	no	no	NT

Tab II. ECoChG Measurements intra- and post operatively

ECoChG measurements could be performed in 5/10 patients. Complications during surgery were the main reason for the drop-out. In some cases, ECoChG responses could not be detected during surgery or at a later appointment.

Audiometric vs. ECoChG Thresholds

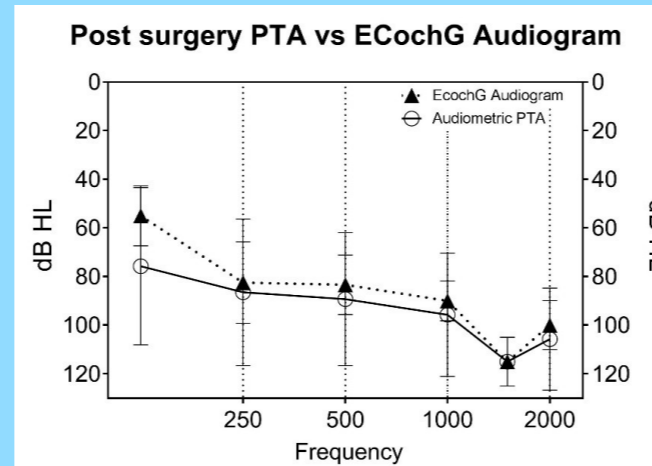


Fig. I. ECoChG audiogram estimation versus post-operatively measured pure-tone audiograms (PTA).

ECoChG threshold estimation shows a good correlation to post-OP measured PTAs.

Audiometric PTA Pre-Post surgery

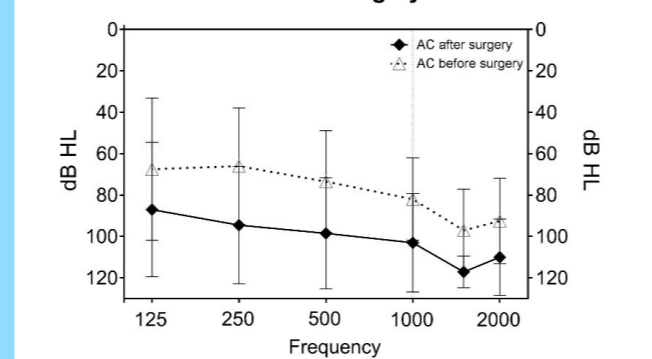


Fig. II. Pure- tone audiograms Pre- and post operatively.

There is a post-OP drop in hearing performance..

Speech Perception Outcomes

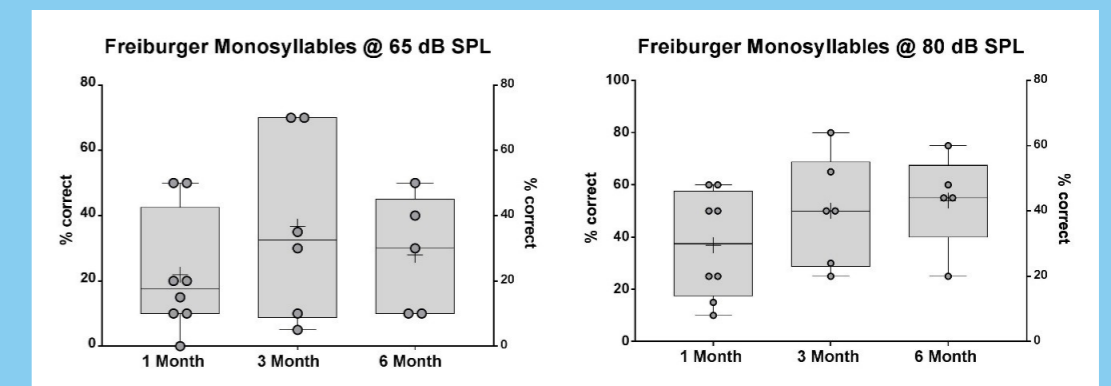


Fig. III. Freiburg Monosyllables speech perception measured at 1/3/6 months interval for 65 & 80 dB SPL . (Graph denotes results for all 10 patients.)

The EAS (electric-acoustic) component was activated in patients with residual hearing initially, but switched to CI-only after measureable ECoChG responses vanished. Speech perception increases over time and shows less deviation when tested at higher presentation levels (80 dB SPL).

Conclusion

Preliminary experience with ECoChG recordings during surgery shows that they can be performed in most patients. Post-operatively measured ECoChGs may disappear over time. Correlations with post-operatively measured pure-tone thresholds are good. Speech perception outcomes are satisfying for the first 6 months after switch-on.