

College of Science

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The Secretary
The Oticon Foundation in New Zealand
142 Lambton Quay
P O Box 9128
Wellington, New Zealand

Dear Ms Pullar,

PROGRESS REPORT: Improvement of intraoperative hearing assessment and prevention of inner ear damage in humans

I am pleased to report that we are making very good progress on the research project.

Since the commencement of the contract on March 1st, 2010, we have recruited Ms Melissa Babbage MAud (Dist), to take the project on for her PhD studies. Melissa commenced her PhD as soon as she had completed her NZAS Certificate of Clinical Competence. Melissa is now a fully qualified Audiologist, and has research experience in the area of intraoperative monitoring, having completed her MAud thesis with myself and Mr Phil Bird as her supervisors.

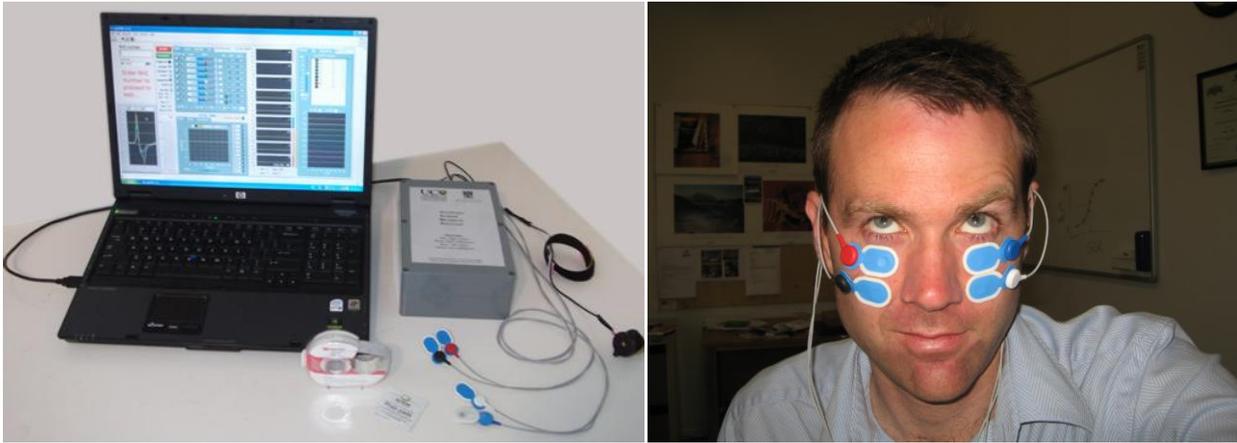
As you know, the current research project consists of three stages:

- Stage 1:** Collection of baseline data regarding the changes to high-frequency hearing acuity and balance function following otologic surgery
- Stage 2:** Development of an intraoperative monitoring system
- Stage 3:** Randomized, double blind, placebo-controlled trial of dexamethasone as a protective agent during otologic surgery

Stage 1 is almost complete. This data was collected by Ms Babbage, Dr Michael Bergin, and Dr Emily Macassey, who have gathered multiple datasets from around 60 patients so far. The patients were adults scheduled for middle ear surgery at Christchurch Hospital, St Georges Hospital, or Southern Cross Hospital, Christchurch.

Our hypothesis was that if there was decreased inner ear auditory function post-operatively as measured by extended high-frequency (EHF) audiometry, then there would also be a drop in vestibular function as manifested by a decrease in the vestibular-evoked myogenic potential (VEMP) measured from below the eyes in response to tap stimuli (known as a tap oVEMP). It was expected that in some patients this deterioration would be temporary, but that in others it would be permanent. Our goal in this first stage was to prospectively:

1. Measure EHF audiometry on patients undergoing middle ear surgery pre-operatively and over the course of several months post-operatively to evaluate surgically-induced cochlear dysfunction; and
2. Perform tap oVEMPs on the same population over the same time period to evaluate surgically-induced otolithic dysfunction.



The recording equipment, electrode placement, and gaze direction used to measure tap oVEMPs.

While it is too early to report on the complete set of findings from this stage, we have several cases in which patients had improved air-bone gaps following their middle-ear surgery, but who had incurred post-operative sensorineural hearing losses, as reflected by their 4 kHz bone-conduction thresholds. These patients also had elevated EHF air-conduction thresholds. Due to the difficulties in separating sensorineural and conductive changes at high frequencies, we're starting to measure EHF bone-conduction (up to at least 16 kHz) using a specialised transducer. Collection of normative data for this transducer is underway.

We are also currently studying ways in which the test-retest reliability of the oVEMP measures can be improved. Because the current method involves a comparison of waveform amplitudes, it is somewhat vulnerable to changes in electrode placement and impedance.

Work is now underway on Stage 2 of the project – the development of an intraoperative monitoring system. Most of the hardware for the system (including amplifiers, ADCs, and the new HF bone-conductor) has been acquired, and work on the software has begun. I have given two invited presentations on this work:

O'Beirne GA, Babbage MJ, Bird PA, 2010. Intraoperative hearing assessment during middle-ear surgery in humans. Medical Physics & Bioengineering Seminar, Christchurch Hospital, Christchurch, New Zealand, 19th October 2010.

O'Beirne GA, Babbage M, Bergin M, Bird PA, Patuzzi RB, 2010. Improvement of intraoperative hearing assessment and preservation of inner-ear function in humans. Clinical Meeting, Christchurch Hospital, Christchurch, New Zealand, 24th August 2010.

This grant has also allowed the completion of a manuscript from Ms Babbage's MAud thesis:

Babbage MJ, Feldman MB, O'Beirne GA, Bird PA, MacFarlane MR, *in preparation*. Early postoperative degeneration of auditory brainstem response Wave I following cerebellopontine angle tumour removal.

This work was supported by the Foundation, who funded Ms Babbage to present this data at the 6th Australasian Auditory Neuroscience Workshop in Canberra in 2009. The Foundation is acknowledged in the manuscript, which will be submitted to an international journal next month.

We would like to thank the Oticon Foundation in New Zealand for their continued support.

Yours sincerely,

Dr Greg O'Beirne
Senior Lecturer in Audiology