

A Normative Study on Tone Burst Vestibular Evoked Myogenic Potentials

By Ong Chun Suan
A0119631J
Supervisor:
Tan Kah Yee

Problem Statement

- Interpretation of cVEMP tests has been largely based on findings from small scale local normative studies or overseas research publications (Basta, Todt, & Ernst, 2005; Isaradisaiikul, Navacharoen, Hanprasertpong, & Kangsanarak, 2012; Janky and Shepard, 2009; Su, Huang, Young, & Cheng, 2004).
- Significant changes in the cVEMP response (latency and amplitude of P1 and N1) have been shown to exist as subjects reach their 60's and 70's (Lee, Cha, Jung, Park & Yeo, 2008; Su et al., 2004; Welgamapola and Colebatch, 2001b).

Specific Aims

- i) To determine normative values of P1 and N1 latencies, corrected amplitude of P1-N1 and asymmetry ratio of cVEMP for Singapore population
- ii) To compare the P1 and N1 latencies, corrected amplitude of P1-N1 and asymmetry ratio of cVEMP between young adults (21-60 years old) and elderly (61-80 years old)
- iii) To compare the P1 and N1 latencies, corrected amplitude of P1-N1 and asymmetry ratio of cVEMP between head rotation and head elevation method

Hypotheses

- i) There is significant difference on the P1 and N1 latencies, amplitude of P1-N1 and asymmetry ratio of cervical vestibular evoked myogenic potentials (cVEMP) between young adults (21-60 years old) and elderly (61-80 years old)
- ii) There is significant difference on the P1 and N1 latencies , amplitude of P1-N1 and asymmetry ratio of cervical vestibular evoked myogenic potentials (cVEMP) between head rotation and head elevation method

Methodology (1)

	Number of subjects	Gender	Age range (years)	Mean (years)	Standard deviation
Group 1	24	10 males 14 females	21-60	28.50	6.67
Group 2	24	8 males 16 females	61-80	65.71	5.15

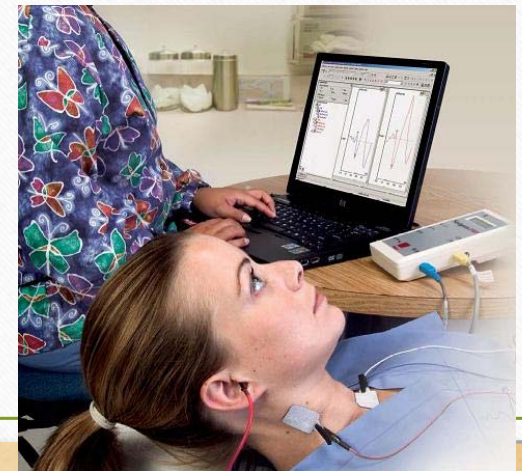
Methodology (2)

- **Screening Procedure**

- History taking
- Basic audiometric tests (Otoscopic examination, Pure Tone Audiometry, Tympanometry and ipsilateral acoustic reflex)
- vHIT and oculomotor tests

- **cVEMP procedure**

- Head rotation and head elevation method



Methodology (3)

Head elevation method



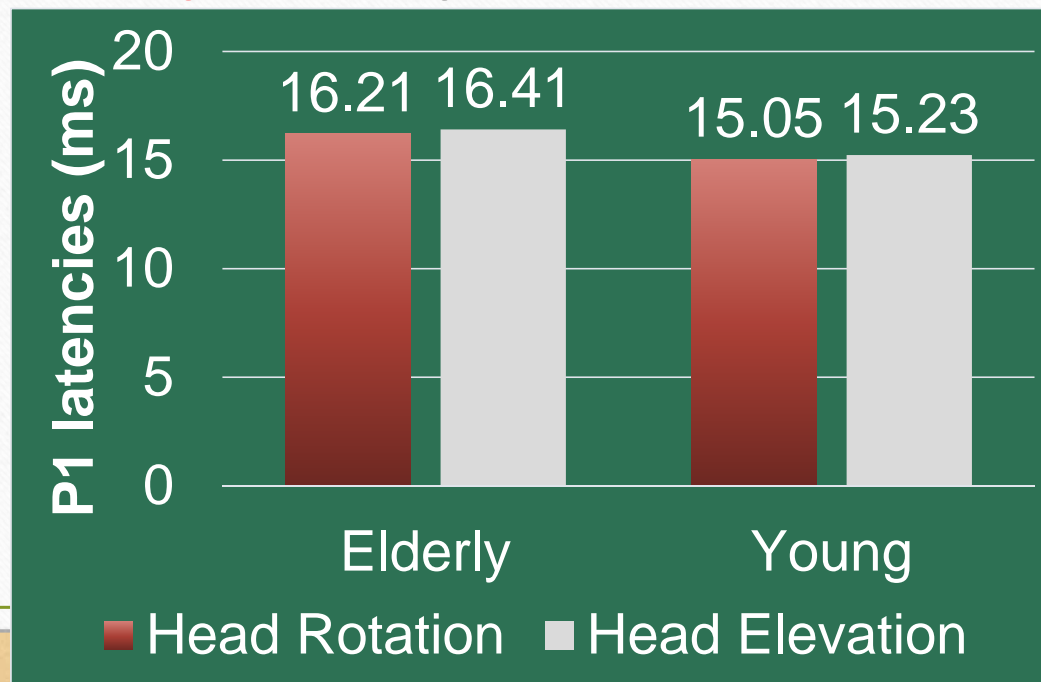
Head rotation method

Results (1): Descriptive Data

	Elderly (n = 24)			Young (n = 24)		
	Mean	SD	Range	Mean	SD	Range
P1 latency (ms)	16.21	1.43	14.42 – 21.50	15.05	0.80	13.42 - 17.34
N1 latency (ms)	25.07	2.10	22.00 - 32.00	24.76	1.72	22.09 - 27.84
Corrected P1-N1 peak-to-peak amplitude (μV)	0.60	0.30	0.25 - 1.29	1.36	0.43	0.70 - 0.45
Interaural asymmetry ratio (%)	14.29	10.56	1.45 - 32.50	13.19	9.06	1.12 - 30.29

Results (2) : Age Effect (P1)

- There was a **significant** age effect on the P1 latency.

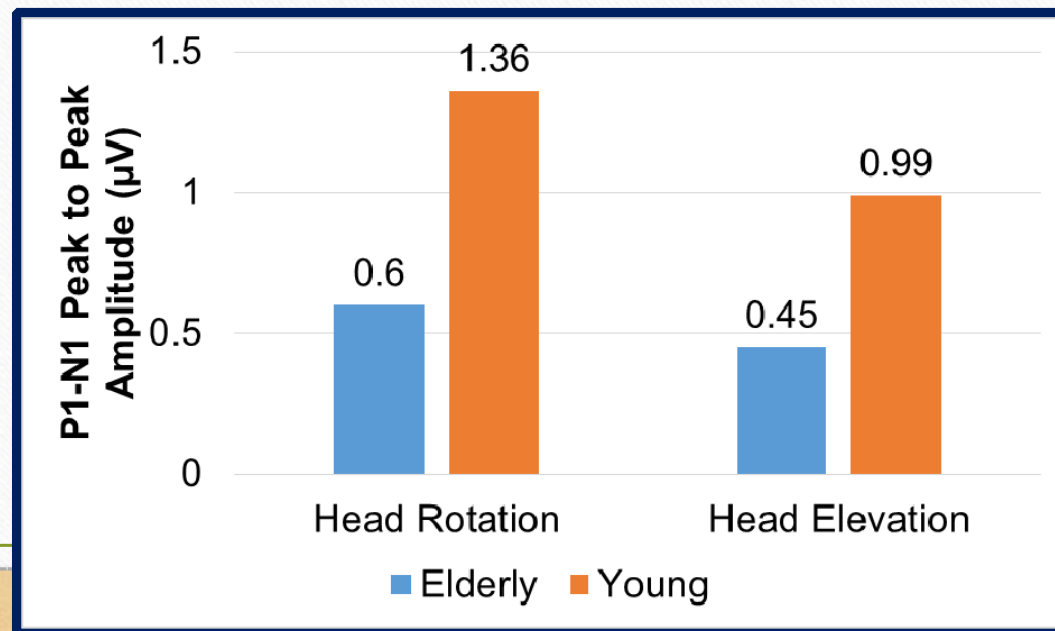


Discussion : Age Effect (P1)

- **Longer time is needed**
 - To process the otolith organ's signal (Furman & Redfern, 2001).
 - To activate the vestibulocollic reflex (Maleki et al., 2014).

Results (3): Age Effect (Corrected P1-N1 peak to peak amplitude)

- **Elderly** < **younger** subjects using both the head rotation and head elevation method.

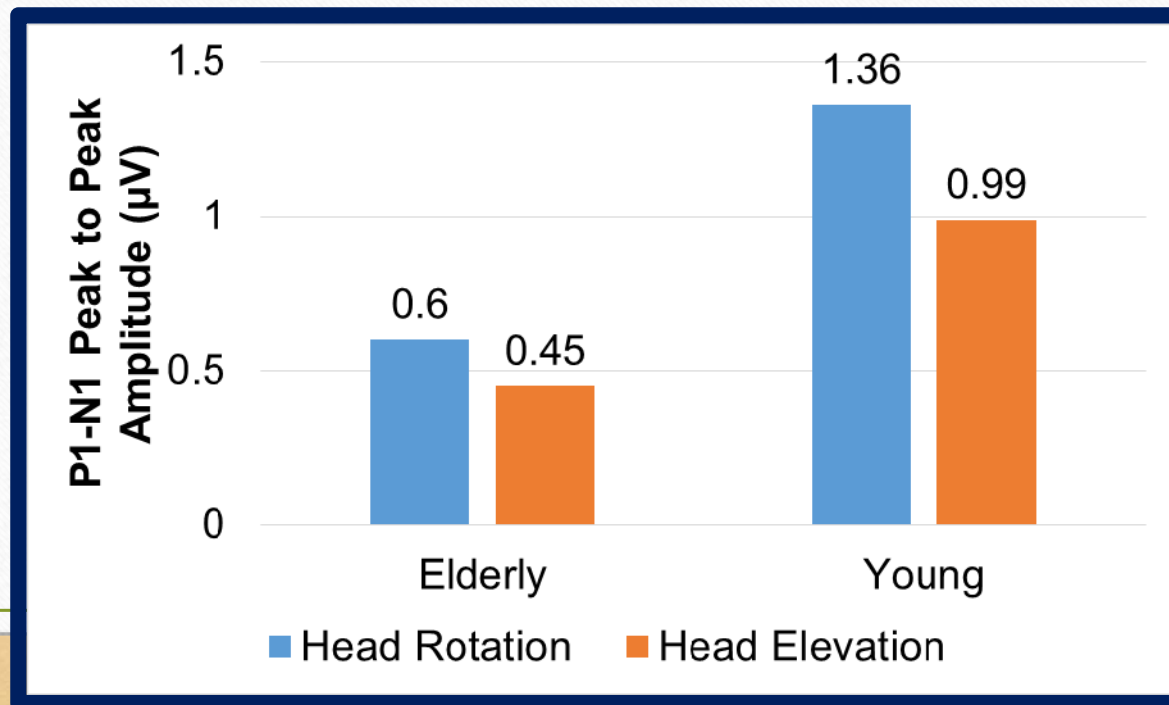


Discussion: Age Effect (Corrected P1-N1 peak to peak amplitude)



- Anatomical and functional changes in the vestibular system (Ochi & Ohashi, 2003; Welgampola & Colebatch, 2001b).

Results (4): Head Position Effect

- Head rotation > head elevation method regardless of age.



Discussion: Head Position Effect

-  muscle effort is needed to maintain the head elevated as compared to the head rotation
-  intensity level is needed to elicit the cVEMP response using the head elevated method (Rahne et al., 2014)

Summary (1)

1. Normative data was established.
2. Different normative values may be applied to population from different age groups.
3. Head rotation method is suggested to be used in the cVEMP testing.

Summary (2)

Stimulus and recording parameters	
Type of stimulus	500 Hz tone bursts
Stimulus intensity	95 dB nHL
Stimulus rate	5.1 Hz
Analog band pass filter setting	10 Hz - 750 Hz
Electrode montage	Non-inverting electrodes: Upper 1/3 of the left and right SCM muscles; Inverting electrode: Upper sternum; Ground electrode: Forehead
Unilateral versus bilateral recording	Unilateral recording
Position	Head rotation in sitting position

Limitations

- **Sample Size**

- Small sample size

- **Stimulus and Recording Parameters**

- 500 Hz tone burst may not be the ideal frequency to stimulate cVEMPs in elderly (Piker et al., 2013).

Future Directions

- **Sample Size and Grouping Method**
 - Recruit more subjects
 - Divide subjects by decade into a few categories from 21 to 80 years old in future research.
- **Stimulus and Recording Parameters**
 - To investigate the effect of stimulus frequency on cVEMP amplitudes in elderly

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