Assessment of the vertical semi-circular canals using vHIT: preservation of anterior canal function in patients with severe to profound hearing loss in criteria for cochlear implant.

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- Vestibular assessment or screening on 90 patients with severe to profound hearing loss listed for cochlear implant
- 38% of patients had normal vestibular function in all six canals
- 11% had absent high frequency vestibulo-ocular reflexes in all canals (Bilateral Vestibular hypofunction)
- 43% had partial vestibular weakness, often involving the lateral and posterior canals but sparing the anterior canals.

**vHIT RESULTS**

**NORMAL**
A normal vHIT result shows gain within the normal range, a normal curve morphology, and no saccades of a significant size

**ABSENT VOR**
A vHIT result suggesting absent VOR shows no curve (or very shallow curve), large covert and/or overt saccades and typically gain will be <0.1

**WEAKNESS**
A vHIT result suggesting weakness in that canal shows a shallow curve, covert and/or overt saccades, and a gain value below the normal range (0.8 laterals, 0.7 verticals).

**EXEMPLARY**

PATIENT A. Female, 41. Childhood meningoïd + progression. No imbalance or dizziness. Clustered, covert saccades suggest that weakness are longstanding and likely well compensated.

PATIENT B. Male, 55. Idiopathic progressive hearing loss. Chronic imbalance, worse in the dark. Note the eyelid artefact in left posterior with genuine covert and overt saccades.


**RESULTS**

These results reflect not only anterior canal sparing but also the higher incidence of artefacts in the posterior canals, the difficulties of interpretation for the right posterior canal, and unusually, the higher incidence of weakness in the left compared with the right lateral canal. There was no correlation between hearing loss aetiology and specific canal weaknesses.

**CONCLUSIONS**

- In Cochlear implant candidates where vestibular function was not normal or completely absent, partial vestibular weaknesses tended to occur in the lateral and posterior semicircular canals.
- With one exception, anterior canal function was only abnormal in cases of bilateral vestibular hypofunction
- These results reflect previous work that describes’ anterior canal sparing in certain pathologies such as Meniere’s disease, aminoglycoside vestibulotoxicity and idiopathic cases (Tarnutzer et al., 2016; Van Stiphout et al. 2022).
- No clear patterns were seen in this cohort with respect to aetiology of hearing loss.
- Speculatively, sparing of anterior canal function may explain why vertical gaze stability exercises are often less provoking than horizontal.
- There were also several cases of isolated posterior canal weakness, which has previously been linked to age-related bilateral vestibular deterioration or ‘Presbyastasis’ (Lerchundi et al. 2020)
- Further work may examine whether vertical canal function has any bearing on post-operative dizziness

**METHODS**

- Full vestibular assessments include a targeted and patient-specific battery which might include vHIT, VNG, mCTSB, positioning, SVINT, Calorics and cVEPPs.
- vHIT performed using Natus ICU Impulse and Otosuite v4.1

**DILEMMA**

This trace may well represent eyelid artefact, though could represent low gain with a cluster of covert saccades. Video playback can be used to review whether the pupil tracking is affected by the eyelid, though slower frame rates may not always catch very quick blinks.

**EXAMPLES**

**REFERENCES**