

Can acquired Auditory Neuropathy Spectrum Disorder (ANSND) be linked to malaria and/or quinine treatment?

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What is ANSD?

Dysfunction of the connection of the inner hair cells and the auditory nerve

and/or

Dysfunction of the auditory nerve

Beck (2010)



General information about ANSD

- Reduced ability to process acoustic information
- May have normal to profound hearing loss
- Hearing loss may fluctuate



Diagnosing ANSD

Present otoacoustic emissions (OAEs)

Electrophysiology testing:

- Absent/abnormal auditory brainstem response (ABR) to high intensity clicks
- Present cochlear microphonic



Case studies: summary

- 'Alile' age 12 and 'Mphatso' age 14
- Neither child had a family history of hearing loss or peripheral neuropathy
- No concerns about their hearing or health before they got malaria
- Poor medical records



Alile

First came to the hearing clinic in
2016, age 11



Key information from history

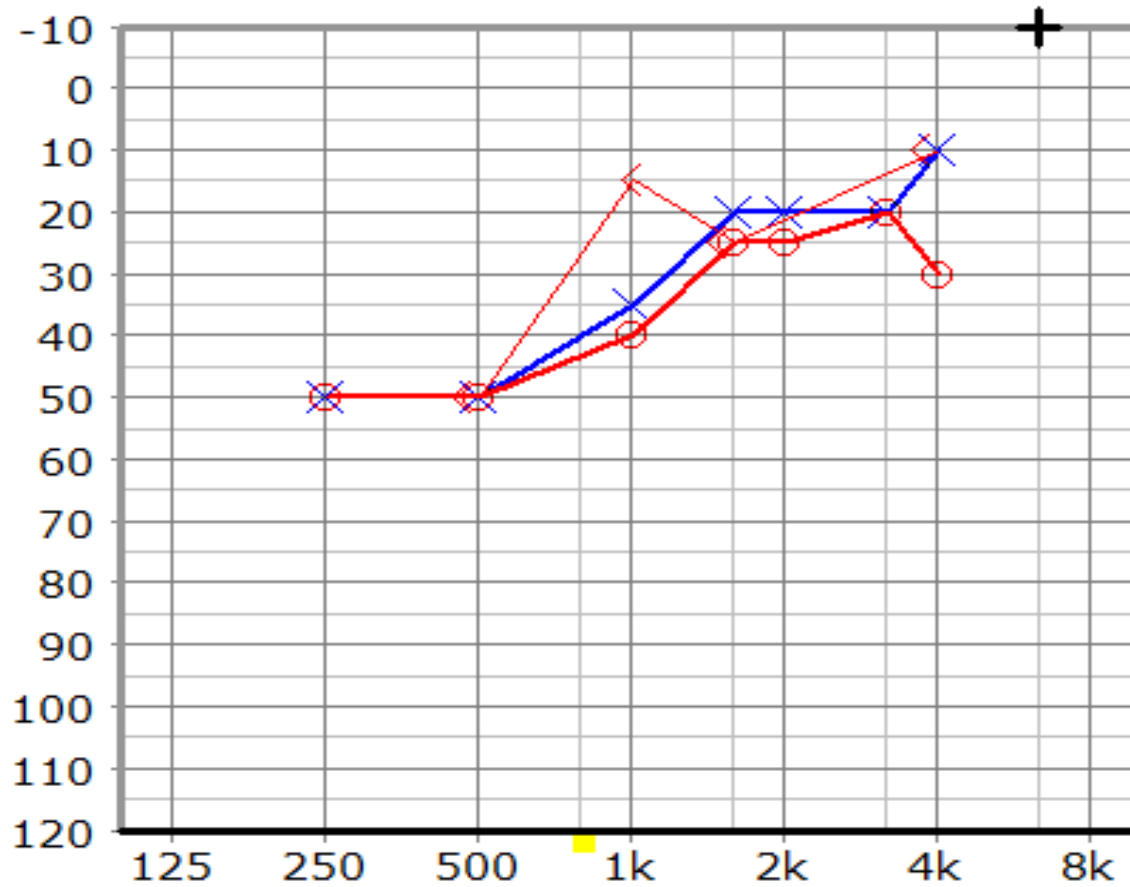
- No health concerns until age 6 when she sustained a head injury with no loss of consciousness.
- No change in hearing following head injury
- The following day developed malaria, admitted to hospital and treated with intravenous quinine
- Family noticed change in hearing immediately as Alile was recovering

Tests/procedures carried out in 2016

- Otoscopy: no abnormalities detected
- Tympanometry: normal bilaterally
- Screening TEOAEs: clear response bilaterally



PTA at age 11



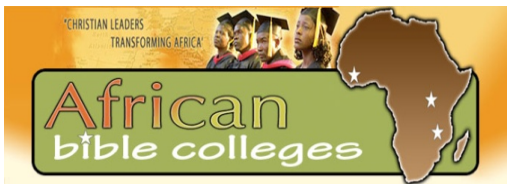
Hearing aid review – May 2017

- Had been using hearing aid regularly and was doing well at school
- Hearing aid broke some weeks ago
- Recently failed school exams, aunt thinks this was due to hearing difficulties
- Had malaria in April 2017, treated with LA (lumefantrine-artemether)



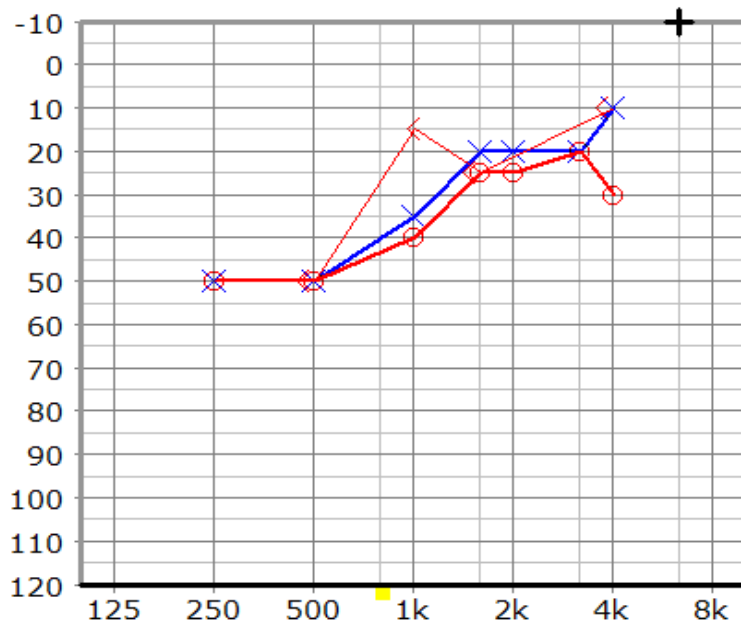
Summary of tests/procedures

- Otoscopy: eardrums intact
- Tympanometry: normal bilaterally
- Diagnostic TEOAEs: Clear response bilaterally
- PTA

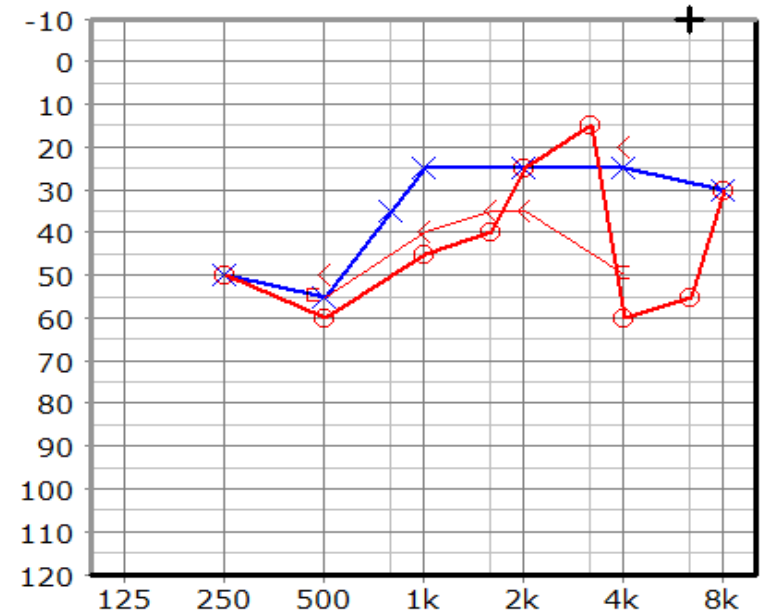


PTA

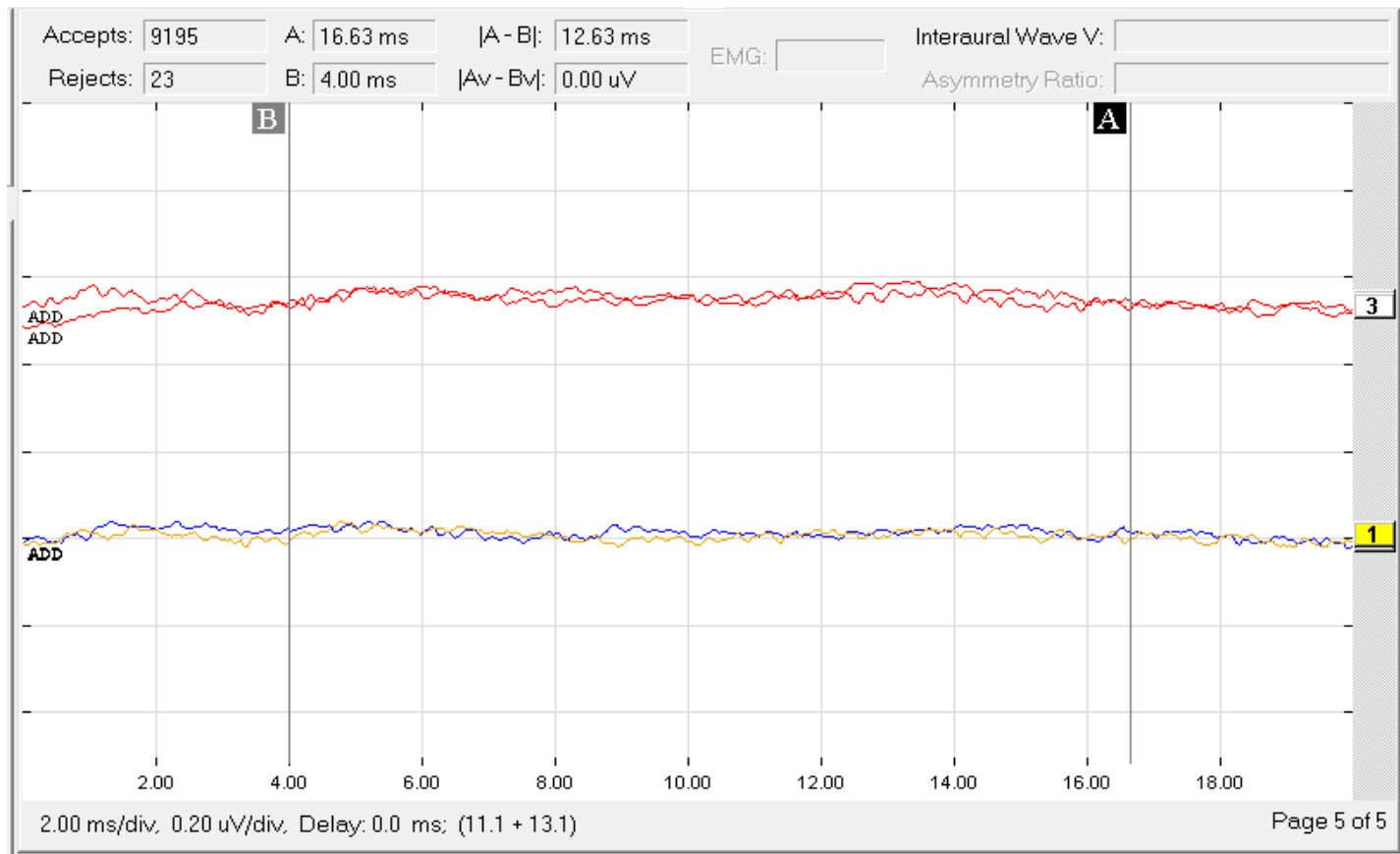
2016



2017



80dBnHL Click ABR weighted add traces



Conclusions/Management

- Discussed ANSD with family and gave written information for her school
- Hearing aids for both ears
- Under regular review and progressing very well



Mphatso

First came to the hearing clinic in
March 2017, age 14



Key information gathered from history

- Mphatso had been healthy and doing well in school (placed 6 in her class of 55 children)
- Severe malaria treated with IV quinine in August 2016
- In September 2016 she developed 'body pains', visual impairment and hearing loss
- Her speech has become quieter and slower
- Failed school exams in early 2017

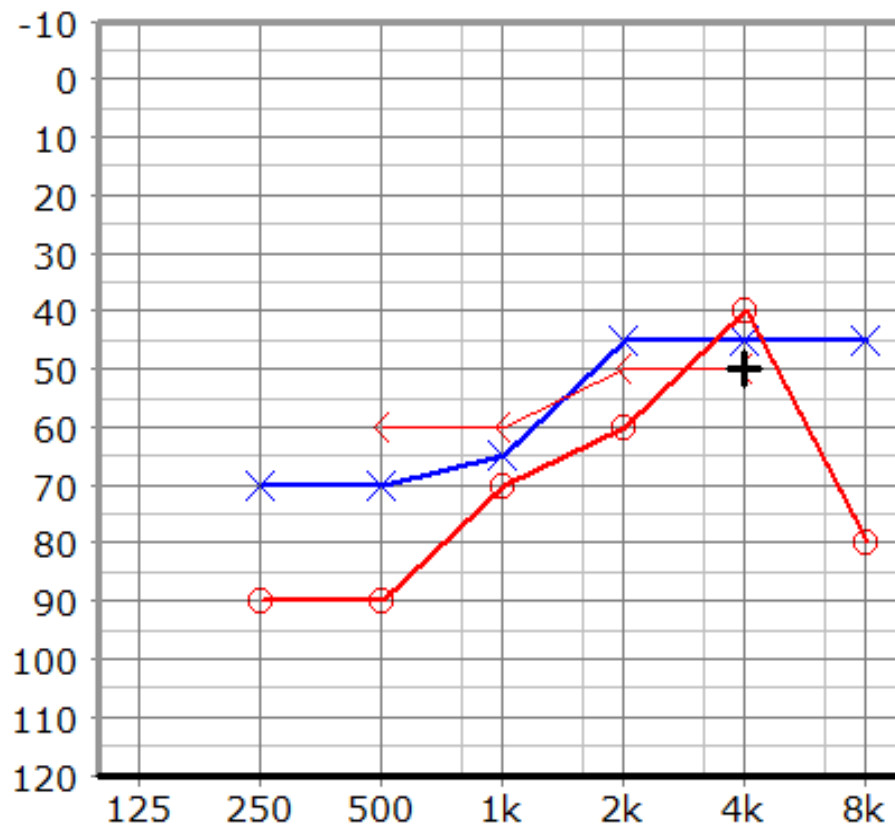


Tests/procedures carried out

- Otoscopy: no abnormalities detected
- Tympanometry: normal bilaterally
- Diagnostic TEOAEs: clear response bilaterally
- PTA: reverse slope sensorineural hearing loss
- Flat traces on click ABR



PTA- March 2017



Malaria and ANSD

- No literature found linking acquired ANSD to malaria
- Malaria can cause hypoxia (oxygen deprivation) (Yusuf et al 2017)
- Hypoxia can cause ANSD (Ngo et al, cited in Manchaiah 2011)
- No way to know whether either Alile or Mphatso suffered from hypoxia

Ototoxicity and ANSD

- Generally ototoxic drugs primarily affect OHCs
- Harrison (1998) demonstrated carboplatin-induced inner hair cell degeneration in chinchillas, with OAEs preserved
- IHC loss thought to be due to sustained cochlear hypoxia
- Can IV quinine cause hypoxia?



Quinine and the auditory system

- Quinine thought to affect both OHCs and IHCs (Alvan et al 2017)
- ‘a concordant view in the literature is that ototoxicity [of quinine] is reversible’
(Alvan et al 2017)
- Trials investigating quinine indicate it can cause reversible hearing loss

Take home messages

- Consider ANSD whenever you identify a reverse slope sensorineural hearing loss
- If a patient has had malaria and has hearing problems, consider acquired ANSD
- In areas where malaria is endemic, OAE testing **and** audiometry should be a routine part of all hearing assessments



Thank you for listening

If anyone has any further ideas as to what may be going on with these children, then please come and talk to me.

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References

- Alvan, G., Berninger, E., Gustafsson, L. L., et al (2017), Concentration–Response Relationship of Hearing Impairment Caused by Quinine and Salicylate: Pharmacological Similarities but Different Molecular Mechanisms. *Basic Clin Pharmacol Toxicol*, 120: 5–13.
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- Yusuf, F. H., Hafiz, M. Y., Shoaib, et al (2017). Cerebral malaria: insight into pathogenesis, complications and molecular biomarkers. *Infection and Drug Resistance*, 10, 57–59.

