Ventilation tube placement as a factor affecting timely amplification fittings for children with trisomy 21 and conductive hearing loss

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Significance

- Hearing loss is common in trisomy 21 (T21) with a prevalence around 40-80% in children. The most commonly reported cause of hearing loss in children with T21 is middle ear effusion (Sait et al., 2022).
- Untreated hearing loss can impact language development (McDermott et al., 2008).
- Although pressure equalization tube (PET) placement is effective, it is less effective for children with T21, who are more likely to have repeat tubes and a greater incidence of middle ear disorders following tube placement (Iino et al., 1999, Omar et al., 2021).
- Bone conduction devices and conventional hearing aids are commonly fit for children with T21 only after multiple unsuccessful PET placements (Sait et al., 2022).

References

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Purpose

Investigate if PET placement affected timely amplification fittings for children with T21.

Methods

A retrospective chart review was performed for children with T21 aged 5-10 years, who were fit with hearing devices, and had at least one audiology visit from May 2012 – August 2022. Participants were excluded if they had a diagnosis of autism spectrum disorder or a history of treatment with ototoxic medications.

Data regarding hearing acuity of the better-hearing ear, PET placements, and amplification fittings were collected from all available medical records. Difficult-to-interpret data were discussed as a group on a case-by-case basis. Amplification fittings that were completed at outside facilities were given estimated dates based off available information in the medical records.

Results

- **24** children with T21 met they study inclusion criteria (15 females)
  - 8/24 were fit with bone anchored hearing devices (BAHD)
  - 16/24 were fit with traditional hearing aids

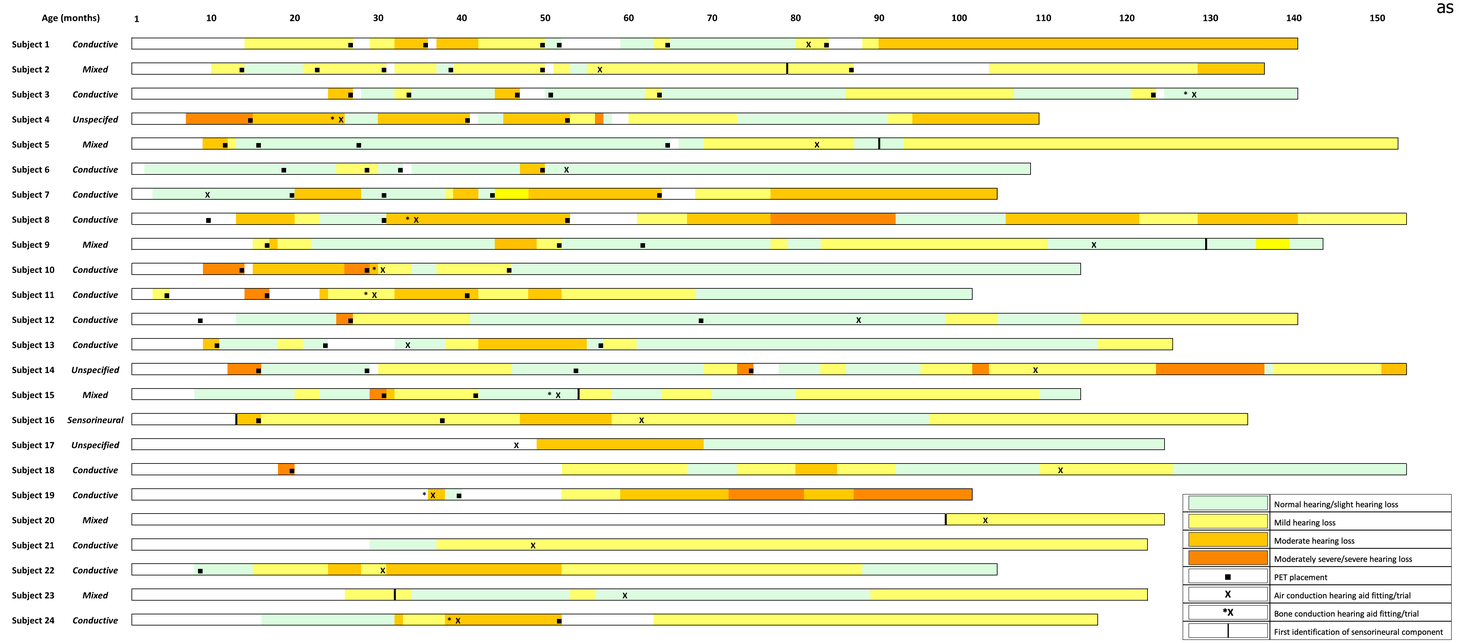

Figure 1: Hearing acuity for the better-hearing ear is plotted as a function of time (months) for each subject. PET placements are denoted by black squares. Air conduction amplification fittings are denoted by black [X] symbols and bone conduction amplification fittings are denoted by black [*X] symbols.

Table 1: The proportion of timely interventions (number of timely interventions/total number of interventions) meeting EHDI guidelines, per subject. Both PET placements and hearing fittings were included as interventions.

	Proportion of timely interventions within 45 days of hearing loss identification	Proportion of timely interventions within 6 months of hearing loss identification
Subject 1	50% (3/6)	50%, 3/6
Subject 2	33% (2/6)	83%, 5/6
Subject 3	44%, 3/7	86%, 6/7
Subject 4	0%, 0/2	0%, 0/2
Subject 5	60%, 3/5	80%, 4/5
Subject 6	60%, 3/5	100%, 5/5
Subject 7	100%, 1/1	100%, 1/1
Subject 8	50%, 1/2	50%, 1/2
Subject 9	50%, 2/4	50%, 2/4
Subject 10	0%, 0/3	66%, 2/3
Subject 11	0%, 0/3	100%, 3/3
Subject 12	75%, 3/4	75%, 3/4
Subject 13	66%, 2/3	100%, 3/3
Subject 14	20%, 1/5	40%, 2/5
Subject 15	33%, 1/3	66%, 2/3
Subject 16	0%, 0/3	33%, 1/3
Subject 17	100%, 1/1	100%, 1/1
Subject 18	50%, 1/2	50%, 1/2
Subject 19	100%, 1/1	100%, 1/1
Subject 20	0%, 0/1	100%, 1/1
Subject 21	0%, 0/1	100%, 1/1
Subject 22	50%, 1/2	50%, 1/2
Subject 23	0%, 0/1	0%, 0/1
Subject 24	0%, 0/1	0%, 0/1
Total	**40%, 72**	**66%, 72**

Of the total number of interventions,
- **40%** met EHDI guidelines of intervening within 45 days following identification of hearing loss
- **66%** met EHDI guidelines of intervening within 6 months following identification of hearing loss

- In this sample, subjects received on average 3 PET placements (range = 1 to 7).
  - On average, subjects received 2 PET placements (range = 0 to 6) prior to their initial amplification fitting.
- On average, these children had 8.9 hearing tests (range = 1 to 18) available for review.
  - On average, 9 (range = 0 to 14) showed hearing loss of mild degree or greater in the better-hearing ear.
  - On average, 2.7 (range = 0 to 10) showed sufficient access to speech and language.
    - **This totals to an average of 497.2 (range = 0 to 1,393.0) days of insufficient access to speech and language.**

Note: Children who have zero hearing tests prior to a hearing aid fitting were fit at an outside facility prior to audiological evaluation at our institution.

Conclusions

- Findings suggest that amplification fittings were delayed for children with T21 and middle ear dysfunction.
- PET placement was common in this group. We speculate frequent PET placement may have delayed audiologists' recommendations for amplification. The National Institute of Health and Care Excellence of England and Wales guidelines suggest amplification is recommended prior to PET placement in this population (NICE guideline CG60).
- Evidence-based clinical management guidelines for the co-treatment of middle ear dysfunction and persistent hearing loss in this population are needed.
- Future research is warranted to investigate how early amplification may affect speech-language outcomes in children with T21 and hearing loss that occurs due to middle ear dysfunction.