

The Use of Transient-Evoked Otoacoustic Emissions in the Assessment of Hearing in Children with Autism Spectrum Disorder: A Retrospective Chart Review

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Background & Objective

Autism Spectrum Disorder (ASD) is a developmental disorder that can impact communication, behavior, and learning. The clinical presentation can include inconsistent/lack of eye contact, not listening to people when spoken to, lack of response to one's name or calls to attention, repetition of behaviors, impaired language development, and sensitivity to sensory inputs like light or sound¹. The lack of response to one's name and other sounds can result in the assumption of a hearing loss, which is why part of the evaluation for ASD may include a hearing test². The attribution of symptoms to one disorder does not inherently rule out the other, thus indicating the necessity of thorough evaluation for both hearing and ASD when suspected.

It is more difficult to assess hearing in children with ASD using behavioral measures as compared to typically developing peers due to their lack of typical responses to test stimuli or limited ability to participate in testing³. Given that Otoacoustic Emissions (OAEs) have been historically used to rule out hearing loss in newborns, this form of assessment can also be used for other populations who cannot be tested behaviorally⁴. Literature regarding the clinical utility of Transient-Evoked Otoacoustic Emissions (TEOAEs) in individuals with ASD is limited. This study aimed to determine the effectiveness of TEOAEs as a tool in the audiologic assessment of children with ASD and other developmental disorders.

Methods

In this retrospective chart review, the following data was collected within a one year period for each patient seen for a hearing test at the Rose F. Kennedy Children's Evaluation and Rehabilitation Center: date of service, gender, age, suspected/confirmed developmental diagnosis, behavioral audiometry findings, tympanometry and TEOAE/DPOAE results, and ABR results. Analyses were conducted in three stages to disentangle diagnostic process from diagnostic outcome.

1. The number of visits per patient (visit burden) was examined as a proxy for diagnostic complexity.
2. Logistic regression models tested whether TEOAE testing independently predicted achievement of a known hearing status.
3. An interaction model tested whether the association between TEOAE testing and diagnostic resolution differed by ASD status.
4. Targeted subgroup analysis evaluated the effectiveness of TEOAEs when behavioral audiometry was not adequate or could not be completed.

Why TEOAEs?

- Quick run-time⁵
- Highly sensitive to cochlear pathologies⁶
- Responses are typically absent when auditory thresholds are greater than 20-30 dB HL and present when thresholds are better, thereby suggesting normal to near-normal hearing when present⁵
- It is known that DPOAEs can still be present in individuals with up to a moderate hearing loss⁶

Data Analysis

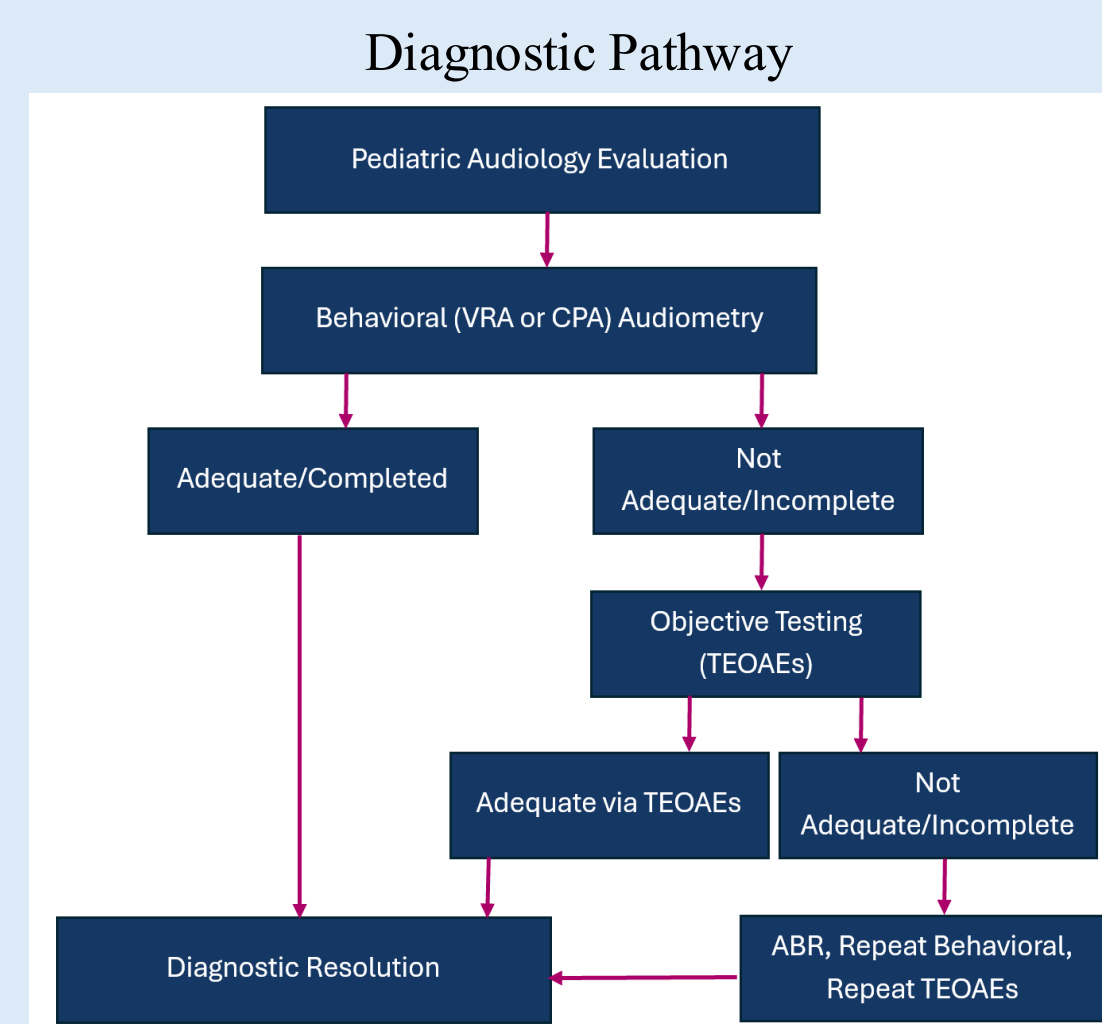


Figure 1. Diagnostic Pathway to determine adequacy of hearing for speech and language development

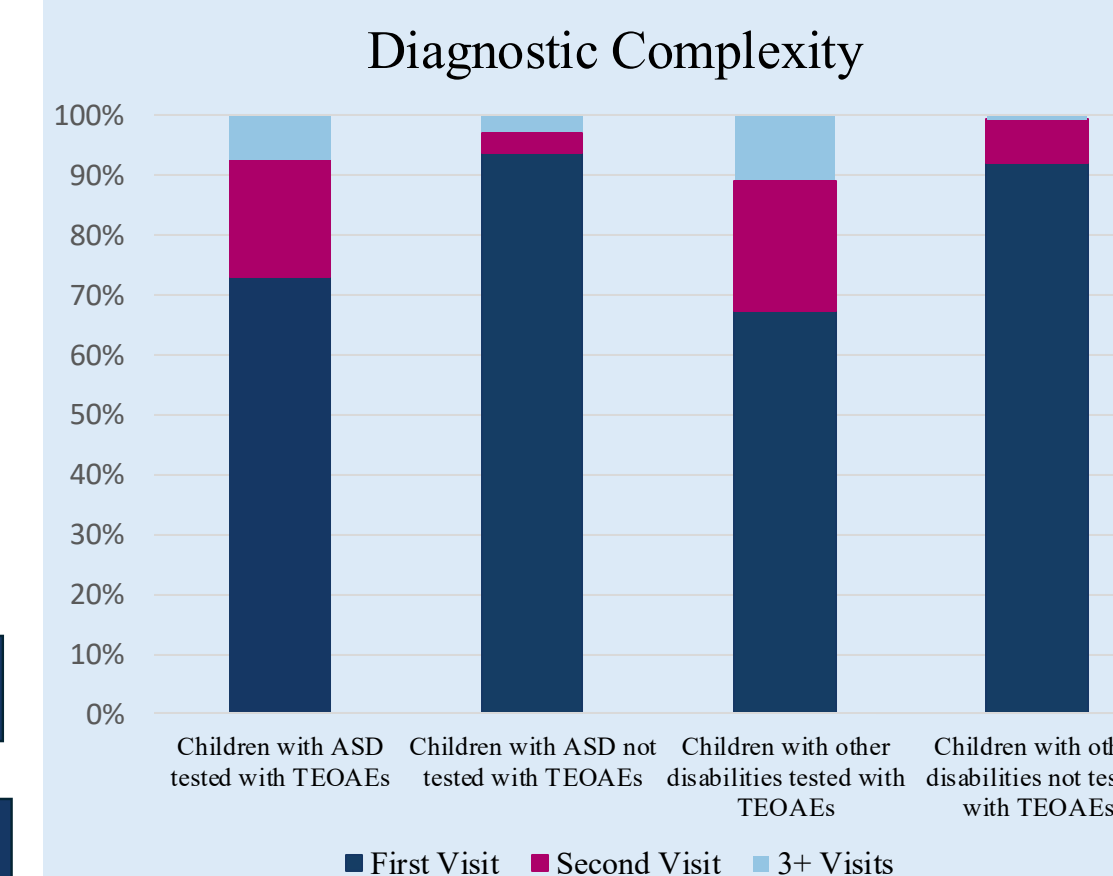
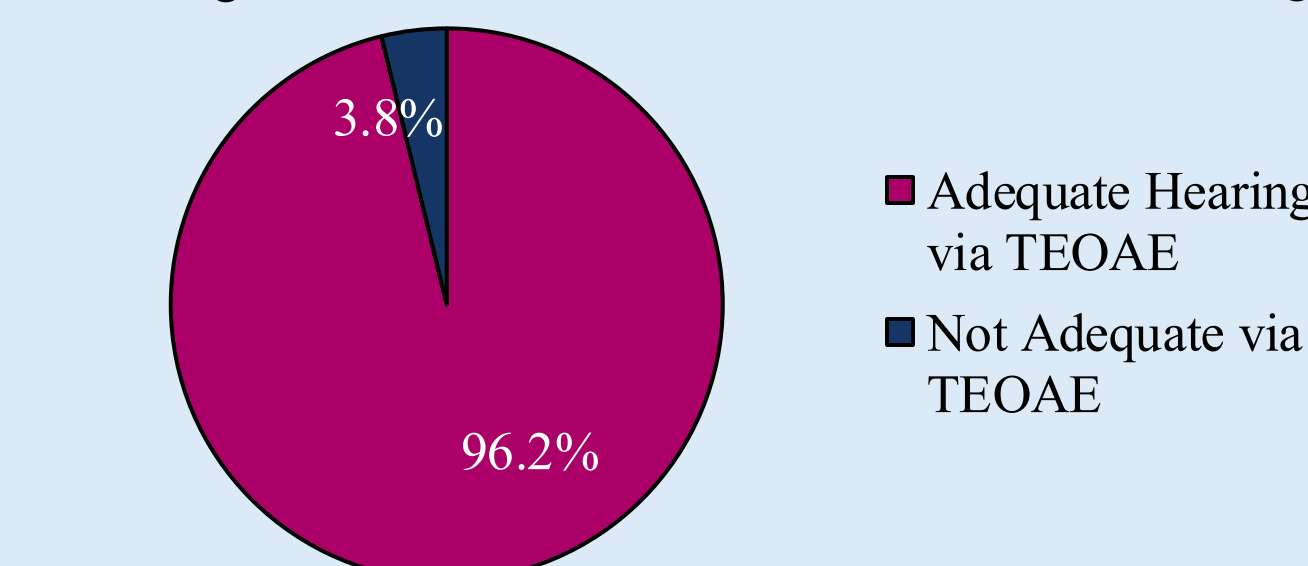


Figure 3. TEOAE usage compared to number of visits

Hearing Status in Children with ASD



Hearing Status in Children with other Disabilities

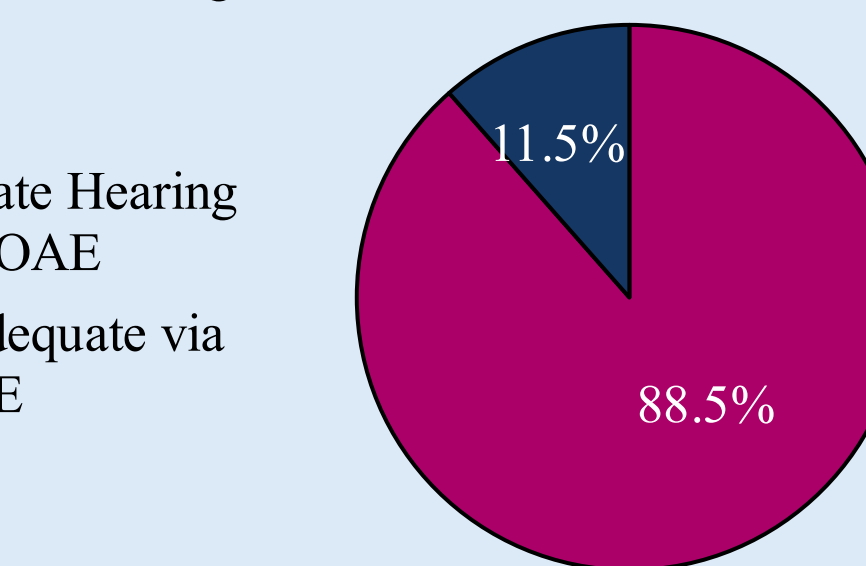


Figure 2. Proportion of children achieved adequate hearing via TEOAE when conventional audiometry failed or was incomplete

Results

- Within the ASD group, children who received TEOAE testing had a significantly greater number of audiology visits than those who did not (Mann-Whitney U = 6442, p < .001), suggesting that TEOAEs were preferentially deployed in diagnostically complex cases rather than in cases resolved in fewer visits.
- In ASD-only logistic regression models adjusting for age, gender, and visit frequency, receipt of TEOAE testing was not independently associated with achieving a known hearing status (OR = 1.07, p = .839).
- Among children for whom behavioral audiometry was not adequate or could not be completed, TEOAE testing was highly successful in establishing adequate hearing. When TEOAEs were attempted in this subgroup, adequate hearing was established in 93.6% of cases. Success rates did not differ significantly between children with ASD (96.2%) and those without ASD (88.5%) (Fisher's exact test, p = .326).

Conclusions & Future Research

- TEOAEs may play a critical role in pediatric audiologic assessment, particularly when behavioral testing is not feasible. Improving access to and completion of objective testing pathways may reduce the prevalence of unresolved hearing status in children with ASD.
- Data may be used in support of incorporating TEOAEs into a protocol for assessing hearing in children with ASD as well as other populations that may be difficult to assess behaviorally.
- The primary barrier to diagnostic resolution appears to be completion of the evaluation process, not failure of objective auditory measures.
- Future research may investigate a 2-step OAE protocol where TEOAEs and DPOAEs are both utilized in the assessment of hearing in children with ASD.
- Future research can further examine correlation between frequency-specific behavioral or electrophysiologic findings with TEOAE results.

References

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