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Striking the Right Balance: Beyond Hearing Loss: The Overlooked Role of Vestibular Function in Children's Balance and Development

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In this edition of "Striking the Right Balance," Melissa Hazen, PhD, MSc, Aud(C), explores the overlooked role of vestibular function in children's balance and development.

Michael Vekasi, AuD, R.Aud, Aud(C), FAAA coordinates the "Striking the Right Balance," feature which will cover the latest information on 'all things vestibular.' If you would like to be more involved in all things vestibular, please check out and like our Facebook page by searching for "CAA National Vestibular Special Interest Group" within Facebook. You can also reach us by email at CAAvestibular@gmail.com.

Picture a playground.

Children are climbing, jumping, and running. Through movement, children develop balance,

spatial awareness, coordination, and confidence. They learn how to navigate their environment, interact with others, and engage with the world around them.

Now imagine that same playground for a child with hearing and/or vestibular loss.

The environment is the same, but the experience is not.

Some children keep up effortlessly. Others hesitate. Some avoid movement altogether. Others fall. The differences can be subtle, but they matter. Over time, they shape participation, learning, and confidence.

There has been a growing body of work examining motor, balance, cognitive, spatial, and academic outcomes in children with hearing and vestibular loss. While we have learned a great deal, these challenges don't always present in simple or predictable ways. The very nature of developmental challenges can be hard for a child or a parent to recognize or describe, which makes it difficult to capture scientifically.

As clinicians and researchers, our goal is to give these children the best chance at successful outcomes. To do that, we need to understand not just *whether* difficulties *exist*, but *how* they manifest in everyday experiences, and *how* we can better identify problems and support solutions.

Understanding the Bigger Picture

Children are not single systems. Balance, movement, learning, and development reflect the integration of sensory, motor, and cognitive processes.

What we know so far:

1. Vestibular impairment is common in children with hearing loss.
2. Balance deficits are also common in children with hearing loss and are more pronounced when vestibular loss is present.
3. Developmental outcomes are shaped by multiple factors, including hearing experience, etiology, comorbidities, and vestibular and balance.

What we are still working toward is understanding how these pieces interact to shape real-world developmental outcomes over time.

Children with Hearing Loss Are At Risk for Vestibular Impairment

Historically, assessing vestibular function in children has been challenging, especially in younger children, who often do not report dizziness [(1)]. Instead, difficulties show up as delays in gross motor milestones, parental concerns, falls, or challenges with activities like riding a bike.

In recent years, pediatric-friendly protocols have improved our ability to assess vestibular function

more reliably, even in children under five years of age [2]. As testing has improved, a clearer picture has emerged.

Vestibular impairment in children with hearing loss is *common* [3,4]. Across studies, approximately ***35–55%*** of children with sensorineural hearing loss demonstrate vestibular dysfunction [5–11]. However, this risk is not evenly distributed. Some children are more vulnerable than others. Vestibular impairment is more likely in children with:

- **Severe-to-profound hearing loss** [9,12]
- **Acquired or progressive hearing loss** [13,14]
- **High-risk etiologies** affecting the inner ear or broader nervous system

Conditions such as *congenital cytomegalovirus (cCMV), meningitis, genetic syndromes (e.g., Usher, CHARGE, Waardenburg), and inner ear malformations* are associated with higher rates of vestibular impairment [8–10,12,15].

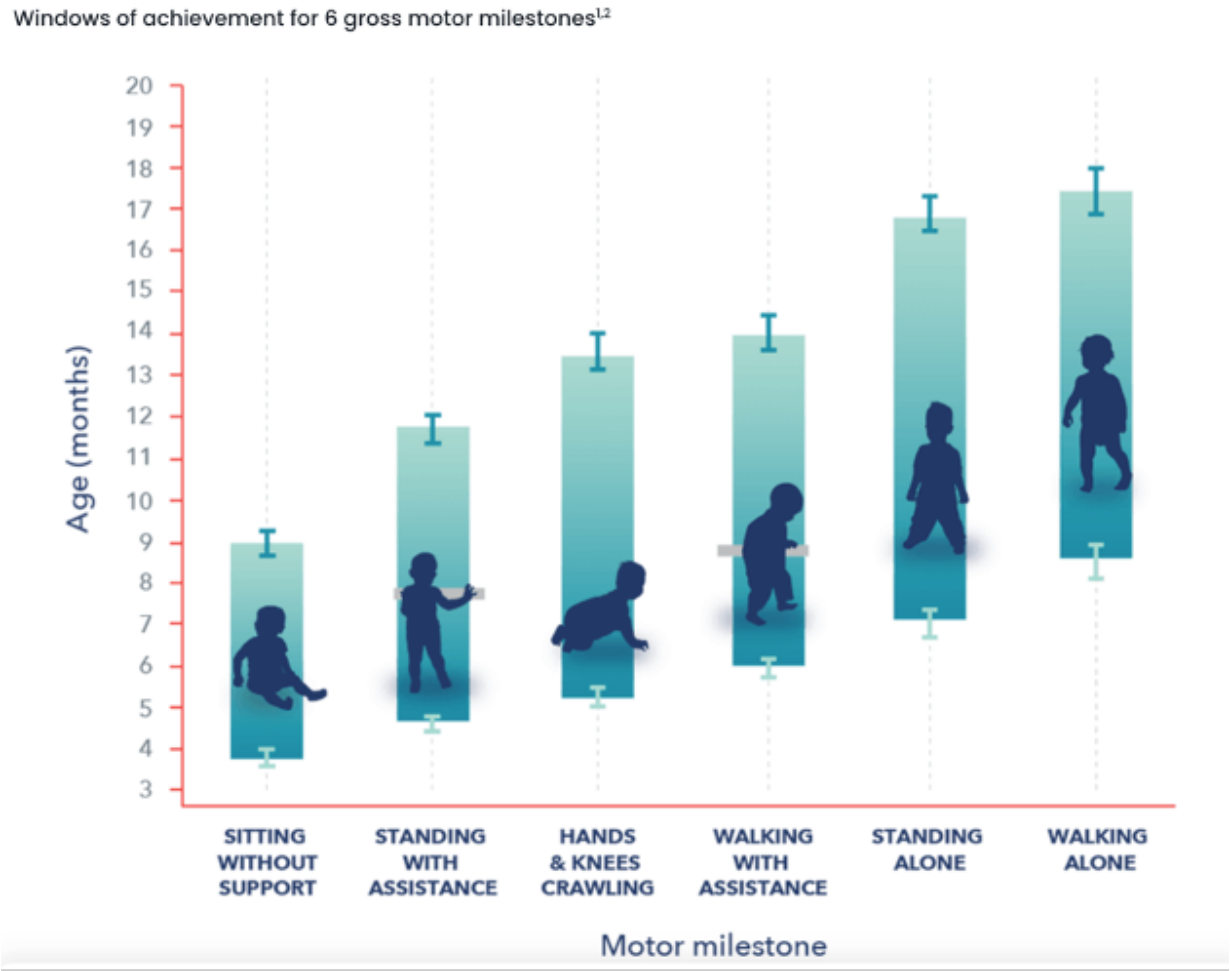
Children with hearing loss should be considered at risk for vestibular impairment and evaluated accordingly, as unrecognized vestibular deficits can shape how children move, participate, and develop.

Children with Hearing Loss Have Poor Balance

Balance is a dynamic process that relies on the integration of multiple sensory systems, including vision, somatosensory input, hearing, and vestibular function [16,17]. When one of these inputs is impaired, balance is affected.

For children with hearing loss, this often manifests as real-world difficulties. They are more likely to experience balance challenges than their typically hearing peers, both with and without measurable vestibular deficits [8]. Children with combined hearing and vestibular loss are at the highest risk for poor balance outcomes. They are more likely to experience delays in motor development [16,18–20], including later achievement of milestones such as head control and independent walking [19,21].

These delays can often be seen early. Motor milestone timelines can help guide this.



WHO Multicentre Growth Reference Study, 2006 [(22)]

Children who **sit later than ~7.25 months** or **walk later than ~14.5 months** may be at increased risk for vestibular impairment [(20)], even though these ages still fall within typical developmental expectations.

This is where clinical judgement matters. Within normal limits does not mean without concern. If a child with hearing loss shows delays in motor milestones or has reported concerns about balance, vestibular involvement should be considered and further testing pursued.

Do These Differences Extend Beyond Balance?

Children with hearing loss demonstrate differences in language, working memory, and academic outcomes compared to their peers [(8,23–26)]. These differences persist even with early intervention, highlighting that early access to sound, while critical, is not sufficient to fully normalize development.

This raises an important question: Do vestibular and balance deficits help explain these developmental differences?

There are plausible mechanisms. One possibility is increased cognitive load. If a child is using more effort to maintain balance and compensate for peripheral sensory deficits, such as hearing and vestibular loss, fewer resources may be available for learning, attention, and participation.

There is some evidence of this. Vestibular impairment can affect dynamic visual acuity (DVA), which is essential for maintaining clear vision during head movement. When this system is disrupted, children may struggle to keep visual targets stable while shifting gaze, which can impact tasks such as reading, note-taking, and tracking text [27]. This is why children with vestibular loss may require larger print to read, reflecting reduced reading acuity [27].

There is also emerging evidence that vestibular loss may affect specific cognitive domains such as visuospatial processing and emotion recognition [28]. However, across studies, findings remain inconsistent, particularly for higher-order outcomes like attention [29], executive function [20,28], and working memory [20,26,29,30].

Both hearing and vestibular impairments play a role in how children learn and function - but their relative contributions remain an area of active research.

Clinical Takeaways

1. Ask about motor milestones

When did the child sit independently? Walk? Ride a bike?

Delays here often reflect real-world balance challenges that may not show up in the booth. Sitting later than **~7.25 months** or walking later than **~14.5 months** may indicate increased risk for vestibular impairment [20].

2. Ask about dizziness and parental concerns

Parents often notice issues before we measure them. Ask directly about dizziness, falls, and overall stability.

Parental concern is a meaningful clinical indicator and should not be overlooked [20].

3. Screen vestibular and balance function in children with hearing loss

Balance deficits are common, and more pronounced when vestibular loss is also present.

Screening is especially important in higher-risk etiologies (e.g., cCMV, meningitis, genetic syndromes), where baseline vestibular testing should be considered.

Screening vestibular function can be completed bedside, without the need for equipment:

- **Dynamic Visual Acuity (DVA)**
  Assesses vestibulo-ocular reflex (VOR) function during head movement

  Red flag: loss of 3+ lines [27,31]

- **Single-Leg Stance (eyes closed, school-aged children)**

Sensitive to bilateral vestibular loss

Red flag: <4 seconds [20,32]

- **Bedside Head Impulse Test**
  Screens semicircular canal/VOR function

  Red flag: corrective “catch-up” saccade [33]

These tools help determine who needs referral for comprehensive vestibular testing.

Hearing and vestibular impairments don’t just affect balance. They show up in the classroom, in fatigue, in participation, and in how children keep up with their peers.

When we consider the factors that drive variability between children, such as etiology, comorbidities, and performance outside the sound booth - we begin to see the full picture. Some of these differences are subtle, but over time they shape confidence and learning.

What is encouraging is that we are getting better at capturing these everyday challenges. That allows us: to identify children earlier, understand them more completely, and design interventions that translate into meaningful improvements in daily life.

If you’re unsure how to implement this in your practice, reach out and connect.

Because in children, we are not just measuring their sensory systems. **We are shaping their lifelong outcomes.**

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