EXPLORING VESTIBULAR DYSFUNCTION IN PAEDIATRIC DEVELOPMENTAL AND LAERNING DISORDER

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UNIVERSITI MALAYA | FAKULTI PERUBATAN *Faculty of Medicine*

HEALeR
Heal • Engage • Act • Lead • Reflect

VESTIBULAR SYSTEM AND DEVELOPMENTAL MILESTONE & LEARNING

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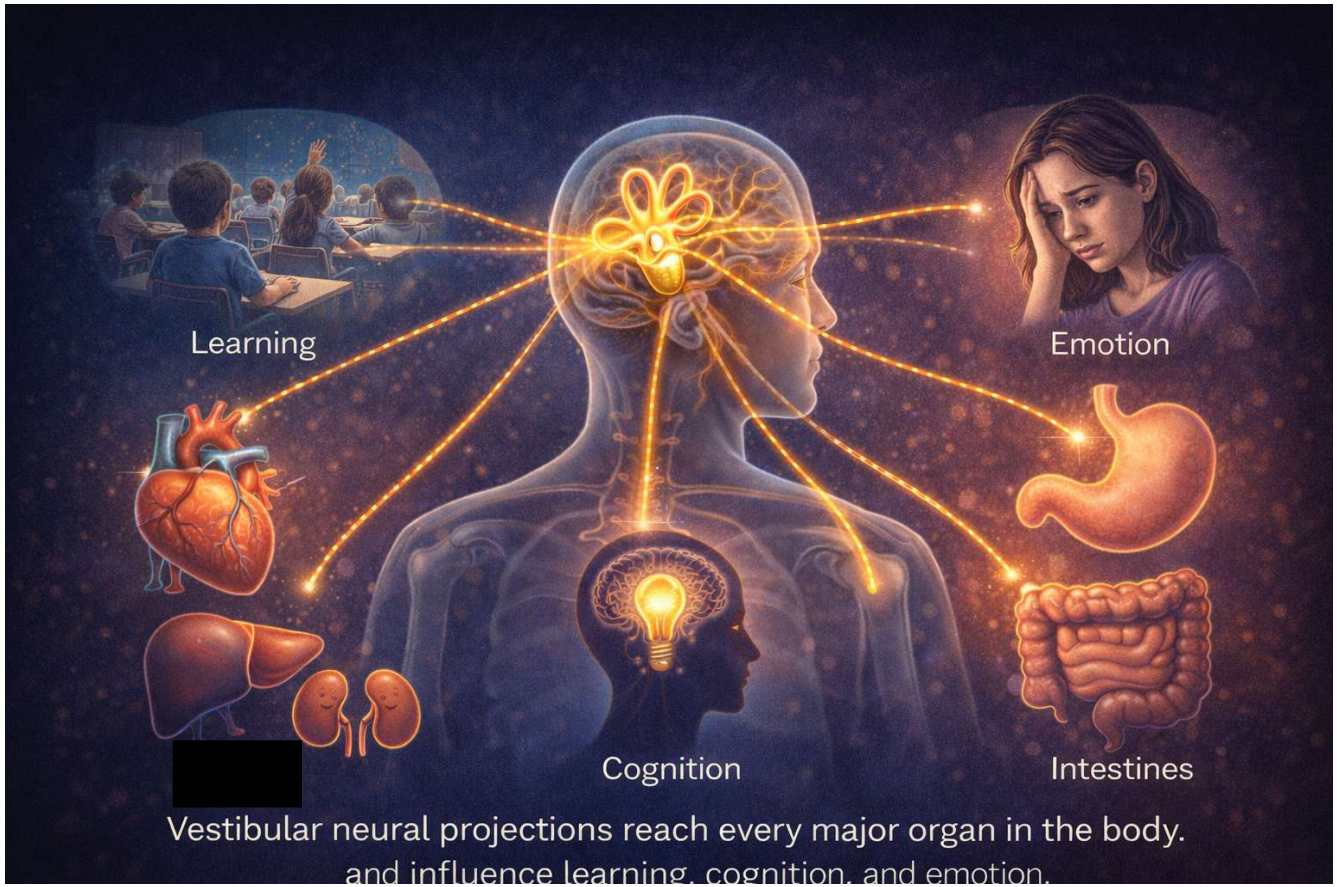
Why is the vestibular system magical?

Vestibular system has neural projections to every organ



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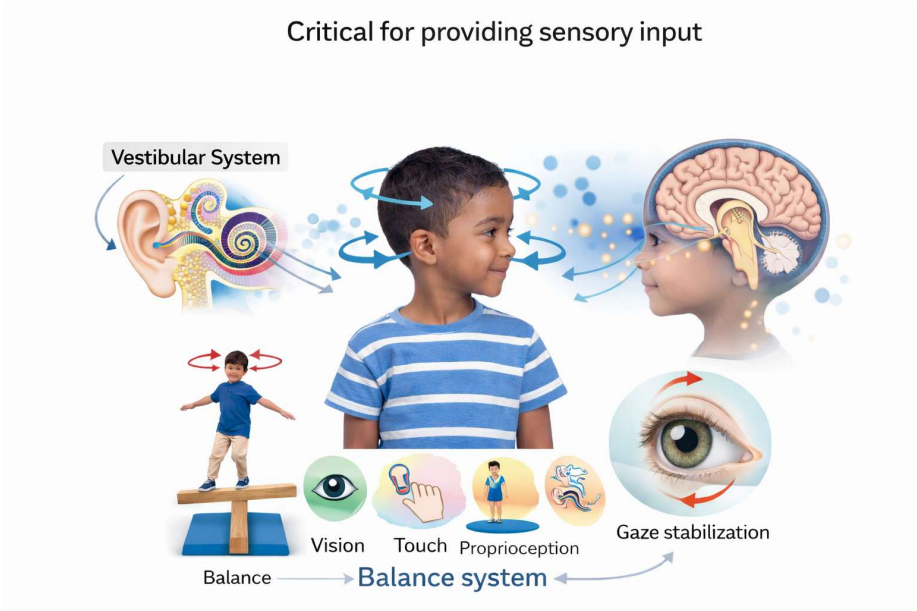
The vestibular system



- Critical for providing sensory input
- Maintain gaze stabilisation during head motion
- Essential component of the balance system

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THE VESTIBULAR SYSTEM

an internal GPS system for the body

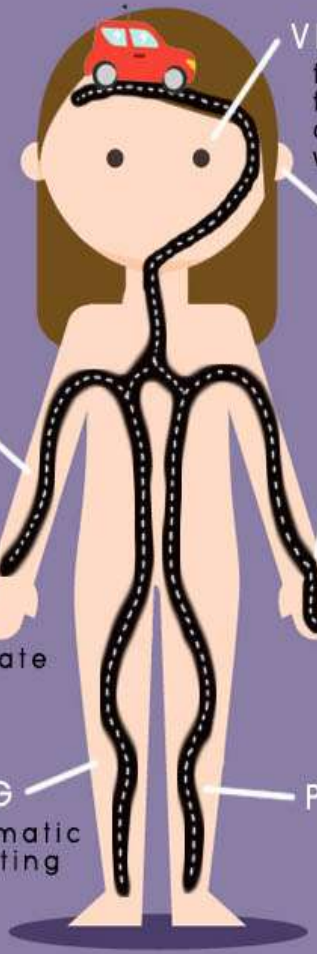
CAR -
Where the vestibular is housed (You begin at home)

ROADS -
Vestibular or GPS system sends messages and signals of which roads the body must follow

DESTINATIONS -
Where your vestibular system directs you to

BASE OR GROUND -
Gravity (The vestibular tells the body where it is in relations to time and space)

INTEGRATED
Learning Strategies



VISUAL
tells the eyes what they are seeing in correlations with objects, words, etc

AUDITORY
tells your ears what to receive, store, and recall

MUSCLES, JOINTS, TENDONS
tells the body how to move in space (balance,coordination)

MOTOR PLANNING
tells the body how to respond to motor skills

HAND-EYE CORDINATION
tells the body how to coordinate the eyes with the hands for tracking, reading, writing

TACTILE
recognizes textures, sensory information in their environment

BEHAVIOR, ATTENTION, FIDGETING
helps a child's actions become automatic so they don't have to think about sitting in their chair, listening to what the teacher says, regulating emotions

PROPRIOCEPTION
How we sense objects and interpret messages

Vestibular dysfunction has been well described in the adult population

Vertigo, dizziness, unsteadiness, and falls

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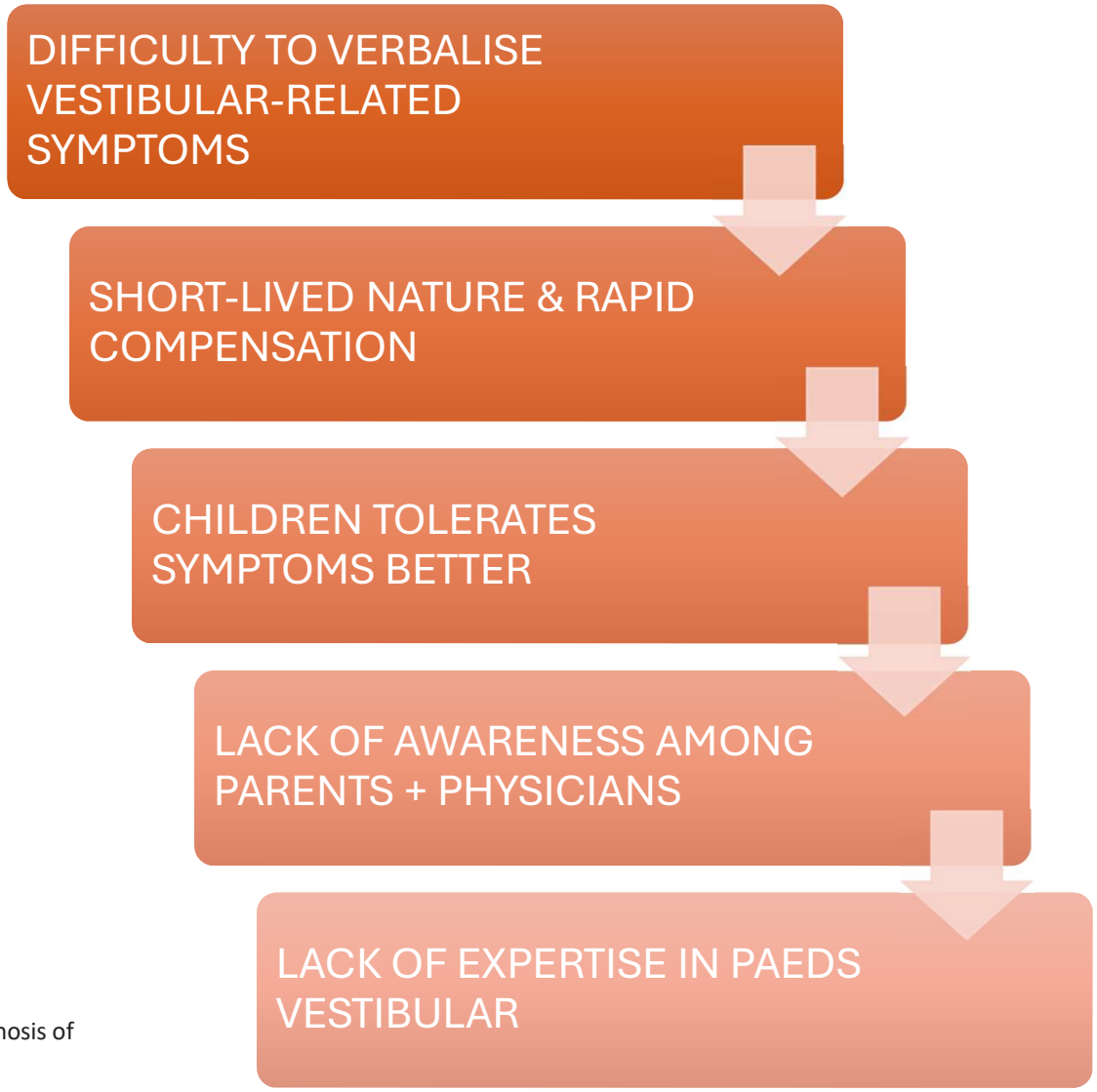
VD manifestations are **different in children compared to adults**

CHILDREN VS ADOLESCENTS
ARE ALSO NOT THE SAME !!!

Prevalence of dizziness in children ranges between **0.7 and 15 %**



Gioacchini FM, Alicandri-Ciufelli M, Kaleci S, Magliulo G, Re M. Prevalence and diagnosis of vestibular disorders in children: a review. Int J Pediatr Otorhinolaryngol. 2014 May;78(5):718-24

European Archives of Oto-Rhino-Laryngology
https://doi.org/10.1007/s00405-023-07842-z

REVIEW ARTICLE

The global prevalence of vestibular dysfunction in children and adolescents: a systematic review and meta-analysis

Jeyasakthy Saniasiaya[1] · Md. Asiful Islam[2] · Rosdan Salim[3]

Received: 29 November 2022 / Accepted: 13 January 2023

Among 1811 studies, 39 studies (n=323,663) were included in the meta-analysis.

The pooled prevalence of children and adolescents with VD was **30.4%** [95% CI 28.5–32.3%]

The age of the participants ranged from 1 to 19 years

There were discrepancies found in the studies with objective (higher prevalence) versus subjective (lower prevalence) evaluations

VESTIBULAR CONDITIONS IN CHILDREN

0-3 years	3-6 years	6-12 years	13-18 years
Congenital hearing loss	OME	Vertiginous migraine	Vertiginous migraine
Prematurity	Benign paroxysmal vertigo of childhood	Vestibular neuritis	PPPD
Ototoxic medication	Delayed postural motor	Benign paroxysmal positional vertigo	Benign paroxysmal positional vertigo
Syndromic			Somatoform disorder
Benign Paroxysmal torticollis of childhood			Concussion
Otitis media with effusion			Cybersickness
			Recreational noise-induced
			Postural hypotension

Children may not present with typical presentation of VD

as adults

DEVELOPMENTAL DELAY

Delay in Achieving Milestone

ATYPICAL PRESENTATION

Clumsy
Dislikes swings/playground
Exaggerated motion sickness
Difficult to learn to ride a bicycle
Hearing loss

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ATYPICAL PRESENTATION

SCHOOL ATTENDING CHILDREN

Poor handwriting

Struggle to copy from the board (poor eye hand coordination)

Problems with spatial concepts such as left–right or sequencing

Poor memory

Inability to concentrate

Inability to perform dual-task

Easily tired

Avoidance of sports and playground activities

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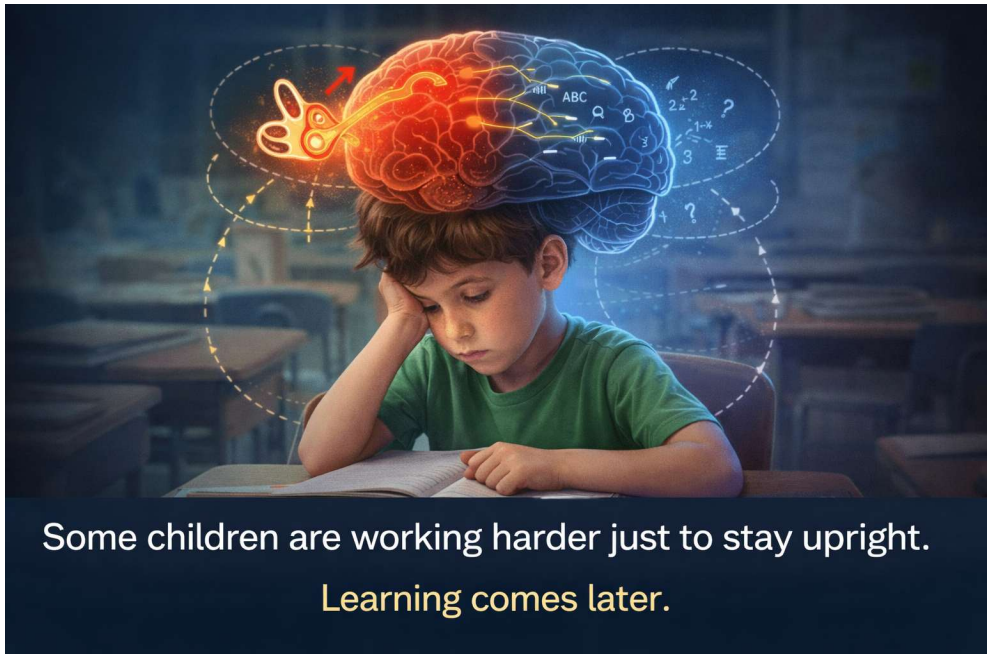
A child with vestibular dysfunction may appear clumsy, restless, or inattentive, but the root problem is not laziness or lack of intelligence

- Appear as psychosocial or behavioural issue
- But the main issue lies in the vestibular system

When the brain is constantly trying to compensate for faulty balance signals

Fewer mental resources remain for learning, memory, and problem-solving



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WHY DO WE HAVE TO WORRY SO MUCH?

- Although there is catch-up due to the compensatory mechanism from the visual and somatosensory
- Sensory re-weighting
- The length of delay of catch-up to typically developing children is UNKNOWN

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IMPACT OF VESTIBULAR DYSFUNCTION IN CHILDREN

Delayed motor and balance

Learning disabilities

Isolation

Impair Psychosocial and QOL

Significant effect to individual, family, society

The role of Vestibular system in

Developmental Delay & Learning Disorders

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Developmental milestones are things most children (75% or more) can do by a certain age

CDC Learn the Signs. Act Early.

CDC's "Learn the Signs. Act Early." Developmental Milestone Resources to Improve Early Identification of Children with Developmental Delays, Disorders, and Disabilities

Julia Abercrombie [1], Lisa Wiggins [1], Katie K Green [1]

Abercrombie J, Wiggins L, Green KK. CDC's "Learn the Signs. Act Early." Developmental Milestone Resources to Improve Early Identification of Children with Developmental Delays, Disorders, and Disabilities. Zero Three. 2022 Sep;43(1):5-12. PMID: 37207257; PMCID: PMC10193264

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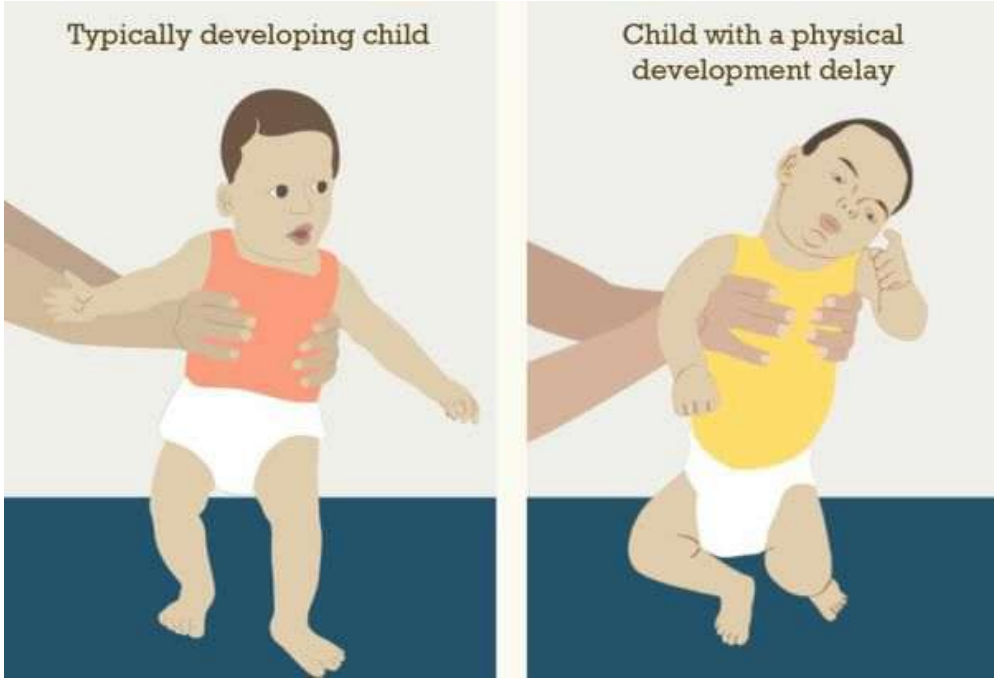
Developmental Delays

- Child fails to attain **developmental milestones** as **compared to peers from the same population**
- Isolated, multiple or global
- Catch-up



Khan I, Leventhal BL. Developmental Delay. [Updated 2023 Jul 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK562231/

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AFFECTED DEVELOPMENTAL MILESTONE

- ❑Head control (by 3–4 months)
- ❑Independent sitting (by 6–8 months)
- ❑Crawling (by 8–10 months)
- ❑Walking (by 12–18 months)
- ❑Balance and coordination (through toddler years)
- ❑Postural control (impacts writing, physical activity)
- ❑Visual–motor integration and reading skills (school age

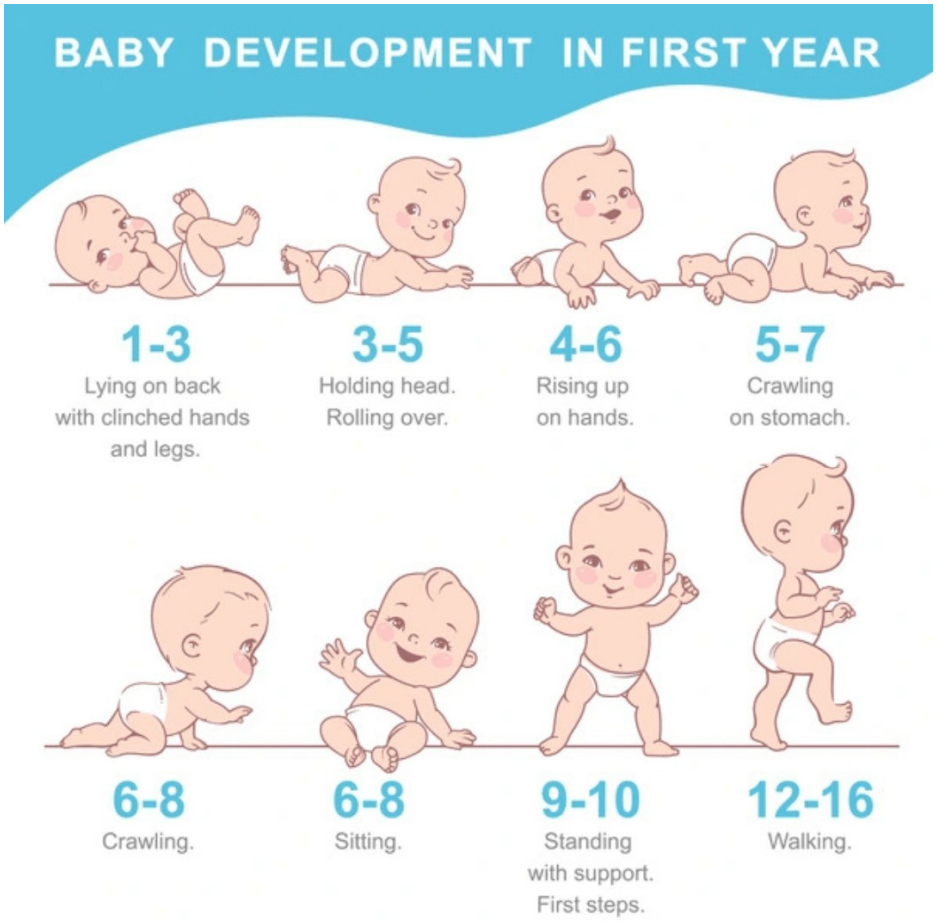
- Physical
- Social
- Language
- Cognition

Failure to achieve head control by **4 months** is abnormal (American Association of Pediatrics)

WHO normative values for typically developing children:

6.6 ± 1.1 months (mean + SD) for sitting

12.1 ± 1.8 months for independent walking



Multicentre Growth Reference Study Group, de Onis M. WHO Motor Development Study: windows of achievement for six gross motor development milestones. Acta Paediatr. 2006; 95(S450):86-95.

Gerber RJ, Wilks T, Erdie-Lalena C. Developmental milestones: motor development. Pediatr Rev. 2010;31(7):267- 277.

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Development of balance and gross motor functions such as **head control and independent walking** are dependent on inputs from the **vestibular, visual, proprioceptive and motor systems** [Kaga, 1999; Suarez et al., 2007]

Inoue A, Iwasaki S, Ushio M, Chihara Y, Fujimoto C, Egami N, Yamasoba T. Effect of vestibular dysfunction on the development of gross motor function in children with profound hearing loss. Audiol Neurootol. 2013;18(3):143-51. doi: 10.1159/000346344. Epub 2013 Jan 31. PMID: 23392310.

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VESTIBULAR REFLEXES

Important for motor development during childhood

VOR: Regulates eye–head coordination of gaze

VSR: Maintain postural control

VCR: Stabilize the muscles in the neck

In addition to routine neurological examination, labyrinthine righting reflexes, the vestibular ocular response and the vestibular spinal reflex should be repeatedly assessed during early childhood

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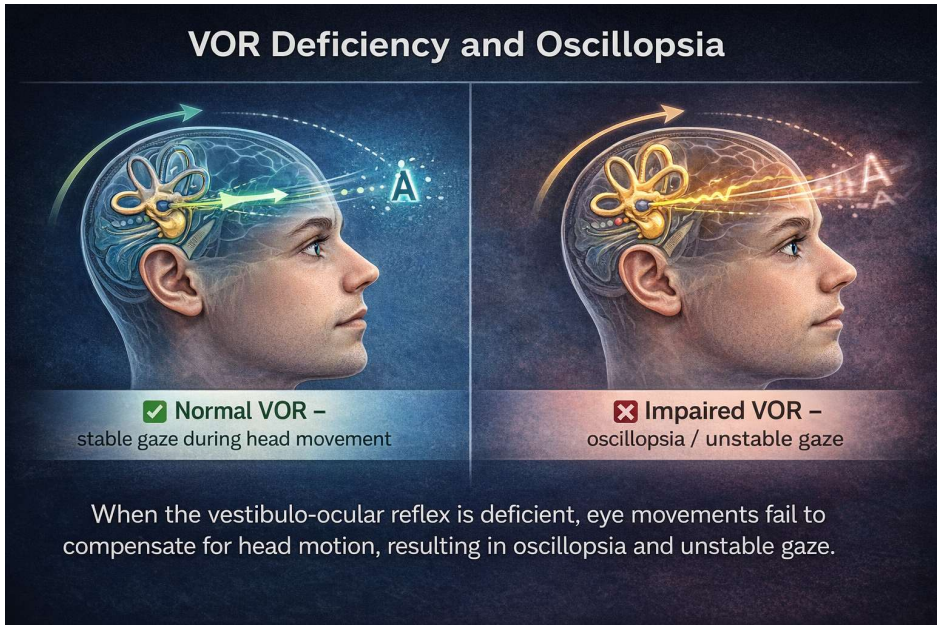
- When the VOR is lacking **oscillopsia or an unstable gaze** will occur while moving the head

- Difficulties with drawing, writing and reading, resulting in a sloppy handwriting and impaired reading performances (Braswell and Rine 2006; Rine and Wiener-Vacher 2013; WienerVacher et al. 2013; Janky and Givens 2015)



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Visuo-spatial skills

Necessary scholastic achievements like mathematics and other non-spatial disciplines where spatial relationships are involved (e.g. syntax, biology, geography etc)

(Szucs et al. 2013; Wiener-Vacher et al. 2013; Cornu et al. 2018)

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Fine motor skills

VOR is crucial for optimal eye-hand coordination

- Necessary for several fine motor performances (Ottenbacher et al. 1984; Cohen and Keshner 1989; Ayres et al. 2005; Wiener-Vacher et al. 2013)
- Children presenting these secondary motor dysfunctions are labeled as clumsy or only having poor fine or gross motor coordination (Casselbrant and Mandel 2005; Rine 2009; McCaslin et al. 2011; O'Reilly et al. 2011; Maes et al. 2014)

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SOCIAL AND EMOTIONAL PROCESSING

Vestibular system has reciprocal projections with neural networks involved in social cognitive and emotional processing (Gurvich et al. 2013; Deroualle and Lopez 2014)

Often dismissed by professionals, symptoms may consequently be attributed to behavioral problems (e.g. autism-related symptoms, ways to draw attention, signs of overactive behavior, lack of empathy)

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ATTENTION!!!

When vestibular symptoms are misunderstood or overlooked

The child's compensatory effort is mistaken for behavioural dysfunction

Children who have experienced these symptoms from birth or infancy **may not recognize their symptoms as abnormal** or may **have learned to compensate** for their dysfunction

SOUNDS LIKE GOOD NEWS?

THINK AGAIN

Robust neuroplasticity among children with compensation from vision and proprioception leads to **delay in the diagnosis of vestibular dysfunction**

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> Int J Pediatr Otorhinolaryngol. 1999 Aug 20;49(3):215-24. doi: 10.1016/s0165-5876(99)00206-2.

Vestibular compensation in infants and children with congenital and acquired vestibular loss in both ears

K Kaga [1]

Affiliations + expand

PMID: 10519701 DOI: 10.1016/s0165-5876(99)00206-2

Motor skills due to vestibular compensation depend on integration of the compensatory input from visual, somatosensory and proprioceptive senses, and the maturation of motor control systems in the cerebellum, basal ganglia and motor cortex

LITERATURE

Mounting evidence on effect on development delay and learning disorder

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Bilateral loss of vestibular function at birth results in motor developmental delays (Rine et al., 2000; Whitney et al., 2009; Wiener-Vacher et al., 2012b)

Compensated with a return to normal postural and oculomotor functions, observations reveal that many of those with **vestibular loss** exhibit **learning disabilities and poorly adapted strategies for overcoming their sensory deficit** (Franco and Panhoca, 2008)

Gaze and fixation problems leads to reading problems requiring specific therapy (Braswell and Rine, 2006)

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Brazilian Journal of Otorhinolaryngology
Volume 74, Issue 6, November–December 2008, Pages 815-825

Original Article

Vestibular function in children underperforming at school

Eloisa Sartori Franco [a], Ivone Panhoca [b c]

VESTIBULAR HYPOFUNCTION in underperforming children

67.4% of the underperformers had peripheral vestibular alterations

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International Journal of Pediatric Otorhinolaryngology
Volume 70, Issue 11, November 2006, Pages 1957-1965

Evidence that vestibular hypofunction affects reading acuity in children

Jennifer Braswell [a], Rose Marie Rine [b 1]

- Reading acuity scores were significantly worse in children with vestibular hypofunction ($p \leq 0.002$)
- Reading acuity scores correlated with dynamic not static visual acuity scores ($r = 0.55$, $p < 0.001$)

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VESTIBULAR CONDITIONS THAT CAN IMPACT DEVELOPMENTAL MILESTONES?

CONGENITAL AND GENETIC CONDITIONS

- SENSORINEURAL HEARING LOSS
- CONGENITAL CMV
- USHER SYNDROME
- CHARGE SYNDROME

NEURODEVELOPMENTAL DISORDERS

- AUTISM SPECTRUM DISORDER
- DEVELOPMENTAL COORDINATION DISORDER

ACQUIRED/PERINATAL CAUSE

- Prematurity
- Periventricular leukomalacia
- Cerebral Palsy
- Infection
- Trauma

VESTIBULAR/CENTRAL CONDITIONS

- Benign Paxysmal Vertigo of Childhood/Vestibular Migraine
- Labyrintitis/Vestibular neuritis
- Vestibulotoxic
- Otitis Media Effusion

HEARING LOSS AND VESTIBULAR FUNCTION

Prevalence of concomitant VD in children with SNHL ranges from 15% to 85%

Wide range?

- Differences in defining what constitutes vestibular dysfunction
- Variation in testing methods or interpretation of test results

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JAMA Network Click to view article >

JAMA Netw Open. 2024 May 23;7(5):e2412846. doi: 10.1001/jamanetworkopen.2024.12846

Vestibular Impairment and Postural Development in Children With Bilateral Profound Hearing Loss

Sylvette R Wiener-Vacher [1,2,✉], Marta Campi [1], Simona Caldani [1,2], Hung Thai-Van [1,3]

Author information · Article notes · Copyright and License information

PMCID: PMC11117085 PMID: 38780940

592 children with bilateral profound HL
+ vestibular impairment: 44%

Delayed posturomotor development in children with HL is a direct consequence of vestibular impairment particularly CBVL

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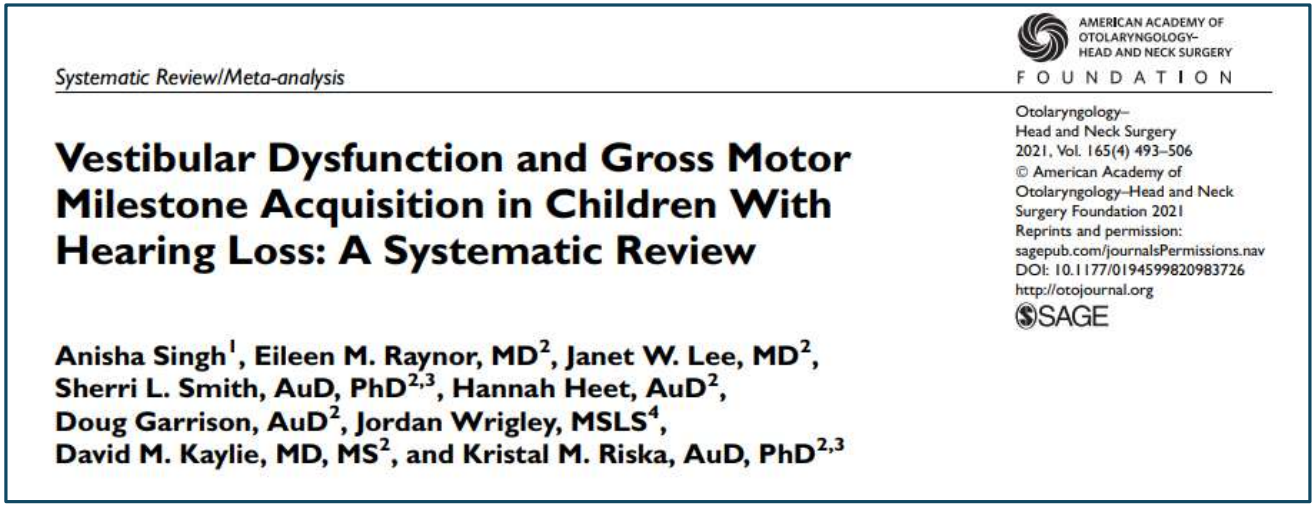

Systematic Review/Meta-analysis

AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

Vestibular Dysfunction and Gross Motor Milestone Acquisition in Children With Hearing Loss: A Systematic Review

Anisha Singh[1], Eileen M. Raynor, MD[2], Janet W. Lee, MD[2], Sherri L. Smith, AuD, PhD[2,3], Hannah Heet, AuD[2], Doug Garrison, AuD[2], Jordan Wrigley, MSLS[4], David M. Kaylie, MD, MS[2], and Kristal M. Riska, AuD, PhD[2,3]

Otolaryngology–Head and Neck Surgery
2021, Vol. 165(4) 493–506

DOI: 10.1177/0194599820983726
http://otojournal.org
SAGE

- 11 studies
- 5 countries (Belgium,France, Japan, United Kingdom,and United States)
- Repeat authors
- The most common testing measures were cVEMP, rotary chair, and calorics
- Gross motor milestones: age at development of head control, sitting, and independent walking; number of children with normal or

- 10 studies: association between vestibular function and the acquisition of gross motor milestones
- Possible dose-dependent impact of vestibular dysfunction on gross motor milestone acquisition

Impacts of VD on gross motor development in children with HL

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Vestibular Function and Gross Motor Development in 195 Children With Congenital Hearing Loss—Assessment of Inner Ear Malformations

*†Yusuke Kimura, *†Takeshi Masuda, and *Kimitaka Kaga

*National Institute of Sensory Organs, National Tokyo Medical Center; and †Department of Otolaryngology–Head and Neck Surgery, Nihon University School of Medicine, Tokyo, Japan

- Relationship between inner ear malformations and vestibular function
  - » Followed up to evaluate the development of gross motor and vestibular function with growth

    Head control and independent walking were used as indicators of gross motor development
  - » CT scans were used to examine the cochlea, vestibule, semicircular canal, internal auditory canal (IAC), and vestibular aqueduct

Vestibular Function and Gross Motor Development in 195 Children With Congenital Hearing Loss—Assessment of Inner Ear Malformations

*†Yusuke Kimura, *†Takeshi Masuda, and *Kimitaka Kaga

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- 195 (HL + language disorders); [Mean: 2.4 ±1.6 yr]
- 15.9% had vestibular function (31/ 195)
- Children with a reduced VOR response showed a significant delay in acquisition of head control and independent walking

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Vestibular function in children with neurodevelopmental disorders: A neglected sense?

Ruth Van Hecke [a,1,*], Frederik J.A. Deconinck [b], Emmely Van Acker [a], Maya Danneels [a], Ingeborg Dhooge [c,d], Hilde Van Waelvelde [a], Jan R. Wiersema [e], Leen Maes [a,c]

[a] Ghent University, Department of Rehabilitation Sciences, Corneel Heymanslaan 10 9000 Ghent, Belgium
[b] Ghent University, Department of Movement and Sports Sciences, Watersportlaan 2 9000 Ghent, Belgium
[c] Ghent University Hospital, Department of Otorhinolaryngology, Corneel Heymanslaan 10 9000 Ghent, Belgium
[d] Ghent University, Department of Head and Skin, Corneel Heymanslaan 10 9000 Ghent, Belgium
[e] Ghent University, Department of Experimental Clinical and Health Psychology, Henri Dunantlaan 2 9000 Ghent, Belgium

Increase otolith reaction in children with NDD

The NDD group exhibited significantly higher interpeak amplitudes on both VEMP tests compared to the control group ($p < 0.001$)

No significant differences were found between the groups on vHIT measurements ($p > 0.05$)

Among the children with NDDs, 11 (39 %) showed atypical vestibular responses, including one child with vHIT correction saccades and three children with reduced or absent otolith responses ($n = 3$)

Additionally, eight children showed abnormally elevated otolith amplitudes (cVEMP > 4.00 μV; oVEMP > 55.00 μV)

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Congenital Vestibular Hypofunction in children with speech and language delay

- Speech and language development require effective sensory processing and sensory integration
- An intact vestibular function is crucial for both sensory processing and sensory integration
- Efimova et al. found that children with language disorders are likely to have vestibular dysfunction, which results in a negative impact on the process of language acquisition

- Ayres, J., *Sensory Integration and Learning Disorders*, Los Angeles, CA: Western Psychol. Serv., 1972.
- Efimova, V.L., Nikolaeva, E.I. The Role of the Vestibular System in the Development of Specific Language Disorders in Children. *Hum Physiol* 46, 306–311 (2020). Available at: https://doi.org/10.1134/S0362119720030032

SPECIFIC LEARNING DISORDER

- Characterized by significantly lower educational skills **(reading, spelling, writing and/or mathematics)**
- Prevalence: 5-15% (School age children)
- Affects
  - » Postural stability
  - » Motor coordination
  - » Spatial orientation
  - » Oculomotor function
- Levinson (1988), which suggested that **cerebellar-vestibular deficits** exist in dyslexia

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SPECIFIC LEARNING DISORDER

- Literature on vestibular involvement in cognitive function has emerged (Gurvich et al. 2013; Hitier et al. 2014; Bigelow and Agrawal 2015; Smith 2017)
- Link with **visuo-spatial skills** crucial for mathematics
- Functional vestibular system is important for normal cognitive development and learning (WienerVacher et al. 2013; Bigelow and Agrawal 2015)

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OUR DATA

Association between Dyslexia and Vestibular function

UNPUBLISHED DATA

Patient Selection

- Pediatric Development Clinic, PPUM
- Persatuan Dyslexia Malaysia (PDM)

Physical examination

- Otoscopy
- Tuning Fork Test
- Neurological examination
- Snellen chart

Vestibular Examination

- vHIT
- cVEMP
- SVV

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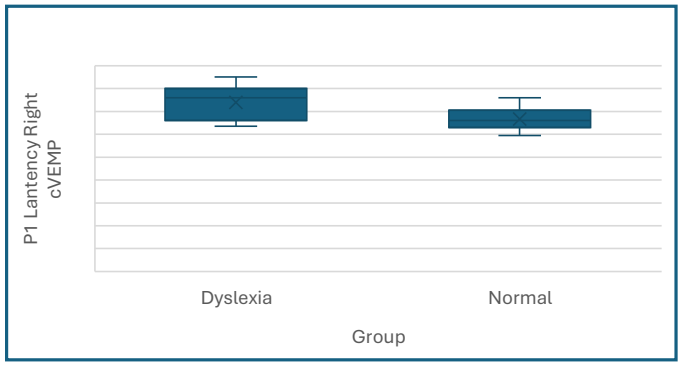
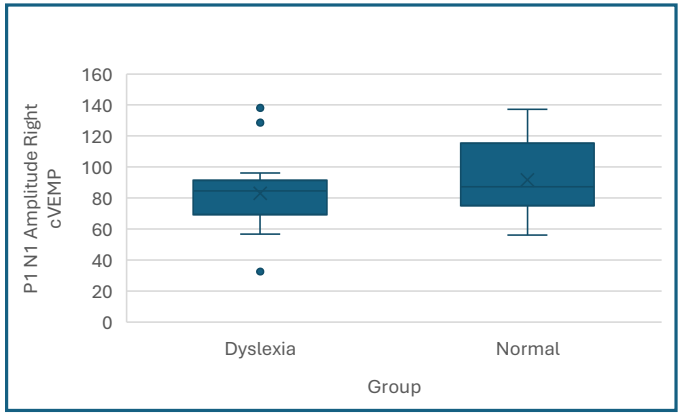
Association between Dyslexia and Vestibular function

Cvemp

	cVEMP, Mean (SD)		cVEMP, Median (IqR)		Cohen's d	Mean difference (95%CI)	t stat	p-value
	Dyslexia	Normal	Dyslexia	Normal				
P1 latency right	14.79(1.41)	13.33(0.98)	15.20(2.80)	1.45(0.54,2.37)	1.20	1.45(0.54,2.37)	3.27	0.003
P1 latency left	14.27(1.09)	13.37(0.80)	14.00(1.40)	0.89(0.17,1.61)	0.94	0.89(0.17,1.61)	2.56	0.016
N1 latency right	27.01(3.88)	23.71(1.76)	26.70(3.70)	3.30(1.05,5.55)	1.10	3.30(1.05,5.55)	3.00	0.006
N1 latency left	24.40(2.19)	23.78(1.81)	24.70(2.30)	0.62(-0.89,2.13)	0.31	0.62(-0.89,2.13)	0.84	0.406
P1-N1 amplitude right	83.13(26.34)	91.71(23.97)	84.60(22.20)	-8.58(-27.42,10.26)	0.34	-8.58(-27.42,10.26)	-0.93	0.359
P1-N1 amplitude left	88.41(25.78)	98.51(21.17)	86.50(47.00)	-10.10(-27.74,7.54)	0.43	-10.10(-27.74,7.54)	-1.17	0.251
Asymmetry ratio	25.02(5.38)	25.92(3.17)	26.50(5.38)	-0.90(-4.20,2.41)	0.20	-0.90(-4.20,2.41)	-0.55	0.583





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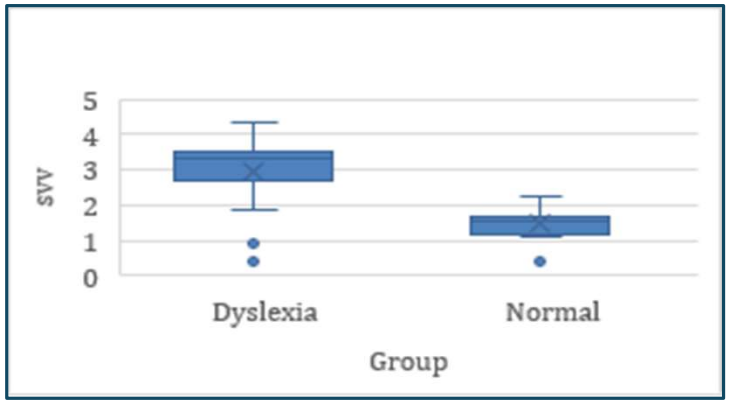
Association between Dyslexia and Vestibular function

SVV

SVV, Mean (SD)		SVV, Median (IqR)		Cohen's d	Mean difference (95%CI)	t stat	p-value
Dyslexia	Control	Dyslexia	Control				
2.94(1.31)	1.47(0.55)	2.67(2.33)	0.40(0.70)	3.01	-3.02(-3.79,-2.26)	-8.26	<0.001



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Association between Dyslexia and Vestibular function

Variables	P1 Latency Right		P1 Latency Left		N1 Latency Right	
	Crude Regression Coefficient, *B*(95% CI)	P-value	Crude Regression Coefficient, *B* (95% CI)	p-value	Crude Regression Coefficient, *B* (95% CI)	p-value
Age	0.18(-0.23,0.59)	0.358	0.04(-0.29,0.37)	0.796	-0.37(-1.51,0.77)	0.498
Age at diagnosis	0.32(-0.20,0.83)	0.210	-0.08(-0.51,0.34)	0.676	-0.12(-1.63,1.39)	0.868
Gender						
Male	0		0		0	
Female	1.15(-0.33,2.64)	0.118	0.02(-1.25,1.29)	0.976	2.49(1.76,6.74)	0.228
Duration of exercise						
<3 months	0		0		0	
>3 months	-0.35(-1.98,1.27)	0.650	0.33(-0.92,1.58)	0.579	2.12(-2.20,6.44)	0.309

Children with dyslexia showed **prolonged cVEMP latencies** and **impaired SVV perception**

Suggesting broader **dysfunction in otolith organ processing**

Altered vestibular contributions to spatial orientation

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Vestibular function in ISOLATED SPEECH DELAY

METHODOLOGY

Study Design

Prospective Case Control Study

Study Setting

Single centre in Otorhinolaryngology clinic, University Malaya Medical Centre (UMMC)

Study Duration

May 2023 – June 2025
(26 months)

Participants

Children aged 3 – 7 years old referred to UMMC ORL clinic for further evaluation of developmental speech and language delay

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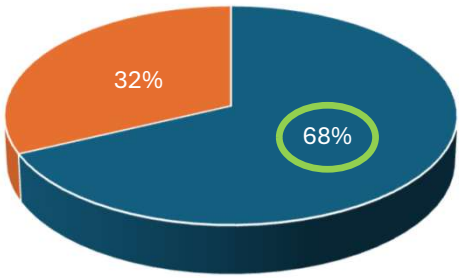
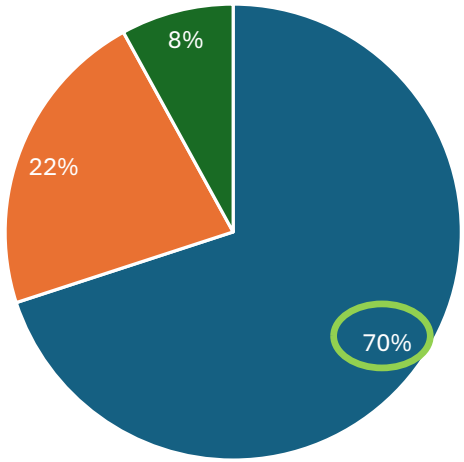
Mean age: 4.5 ± 1.1 years

Gender



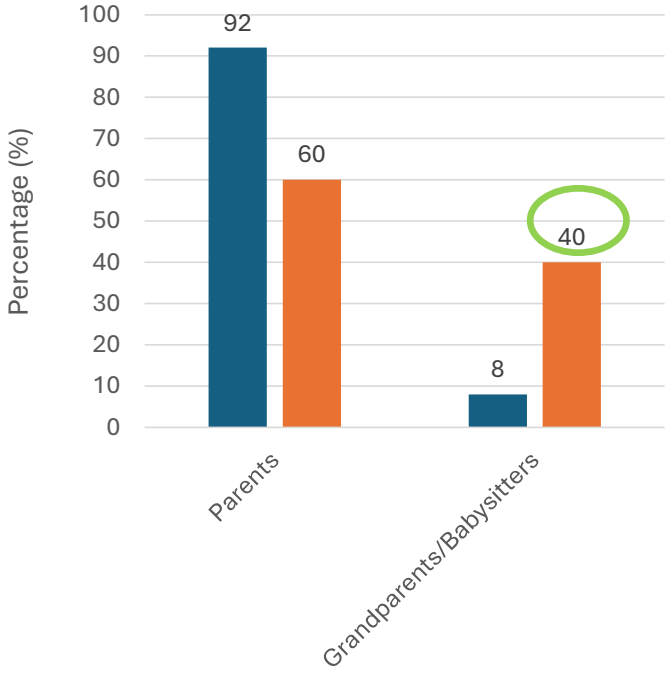
Male Female

Ethnicity



Malay Chinese Indian

Primary Caretakers
(p=0.018)



Control Speech Delay

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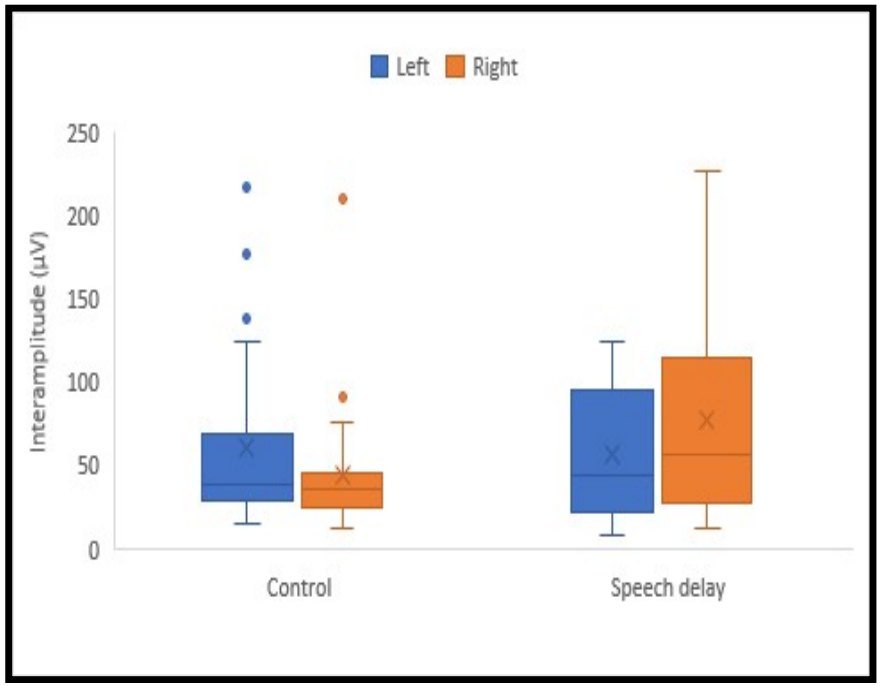

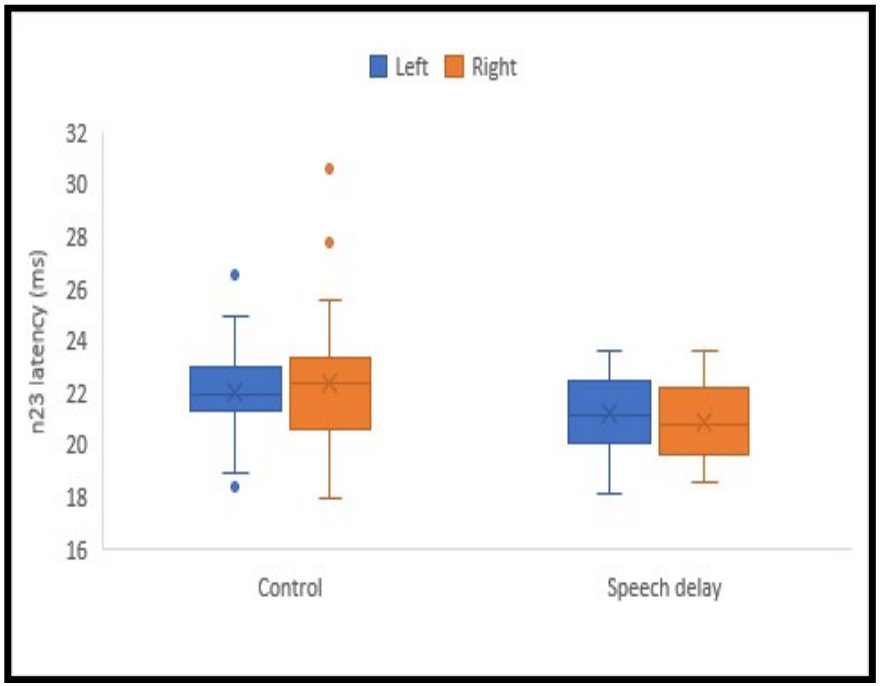

Saccular Function (cVEMP)

- **Right n23 latency shorter** in SLD(20.9ms ± 1.5) VS controls (22.4 ± 2.8), p=0.021
- **Right interamplitude greater** in SLD (77.5 ± 59.5 μV) VS controls 45.2 ± 38.9 μV), p=0.028

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Otolith dysfunction

Immaturity of the vestibulocollic reflex pathway, likely reflecting **delayed myelination**, **reduced neural synchrony**, and **subtle saccular deficits**

Mild vestibular impairment may compromise the coordination of orofacial and respiratory musculature required for intelligible speech

HOW TO APPROACH

- SCREENING
- HIGH RISK CASES

- HEARING LOSS
- DEVELOPMENTAL DELAY
- VESTIBULAR CONDITIONS
- SLOW LEARNER
- LEARNING IMPAIRMENT
- NDD/ BEHAVIOURAL CONDITIONS: AUTISM/ADHD
- MOTIONSICKNESS

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ASSESSMENT

- Vestibular assessment as a part of routine during assessment
- Teach the junior doctors, residents
- Incorporate as a part of national curriculum

ABLE TO DETECT AND REHABILITATE EARLY

International Pediatric Otolaryngology Group (IPOG) Consensus on Vestibular Testing in Children

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Keywords: children | cochlear implant | vertigo | vestibular testing

SIMPLE & PRACTICAL APPROACH

Single leg stance TEST

Age	Duration (seconds) 1 foot standing
30 months	1 (briefly)
36 months	2
4 years	5
5 years	10
≥5 years	Red flag for vestibular impairment
Eyes open	<8 s
Eyes closed	<4 s

Cushing SL, Papsin BC. Special Considerations for the Pediatric Patient. *Adv Otorhinolaryngol*. 2019;82:134-142. doi:10.1159/000490282

Open access Protocol

BMJ Open

Balanced Growth project: a protocol of a single-centre observational study on the involvement of the vestibular system in a child's motor and cognitive development

Ruth Van Hecke ,[1] Frederik J A Deconinck,[2] Jan R Wiersema,[3] Chloe Clauws,[1] Maya Danneels ,[1] Ingeborg Dhooge,[4,5] Laura Leyssens,[1] Hilde Van Waelvelde,[1] Leen Maes[1,4]

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MANAGEMENT

- Plenty of studies on outcome of VRT in children with hearing loss and vestibular impairment
- What about other conditions?
- Are the outcomes similar?

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ROLE OF VRT

Vestibular Rehabilitation Therapy (VRT): Exercise- based approach

Uses plasticity and neural networks of the brain to improve functional activities & QOL

Clinical Trial > Int J Pediatr Otorhinolaryngol. 2004 Sep;68(9):1141-8.
doi: 10.1016/j.ijporl.2004.04.007.

Improvement of motor development and postural control following intervention in children with sensorineural hearing loss and vestibular impairment

Rose Marie Rine [1], Jennifer Braswell, Donna Fisher, Kelly Joyce, Kristen Kalar, Margaret Shaffer

Affiliations + expand

PMID: 15302144 DOI: 10.1016/j.ijporl.2004.04.007

- 21 children with SNHL + VI were randomly assigned to two groups (exercise and placebo)
- Exercise intervention: compensatory training, focused on visual and somatosensory function, and balance training
- Motor development scores significantly improved in the exercise group (P = 0.004) + improvement in posturography scores was evident in the exercise group

BMJ Open

Vestibular Infant Screening-Rehabilitation (VIS-REHAB): protocol for a randomised controlled trial on Vestibular Rehabilitation Therapy (VRT) in vestibular-impaired children

Marieke Fontaine ,[1,2] Ingeborg Dhooge,[2,3] Cleo Dhondt,[2] Ruth Van Hecke ,[1] Frederic Acke,[2,3] Lena Van den Bossche,[2] Helen Van Hoecke,[2,3] Els De Leenheer,[2,3] Leen Maes[1,3]

Primary and secondary outcome measures assess gaze stability, postural stability, motor performance and quality of life

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CONCLUSION

Delay in gross and fine motor function

Pay close attention to children with ‘catch-up’ developmental milestones

Vestibular assessment

Routine assessment in high risk: HL

MDT in assessment and management

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Early detection and early vestibular rehabilitation is associated with improved psychomotor development in children with vestibular impairment

We have yet to find answer

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Allcare

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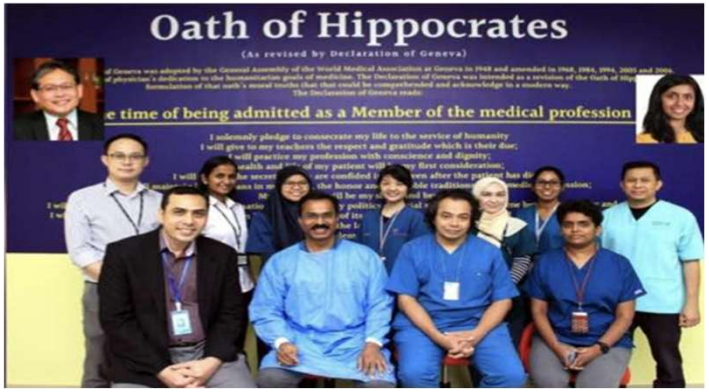

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ACKNOWLEDGEMENT

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AUDIOLOGISTS UMMC

PAEDIATRIC NEUROLOGISTS

PAEDIATRIC REHABILITATION MEDICINE

PAEDIATRIC RADIOLOGIST

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THANK YOU

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