

---

## DISORDERS

---

### TREATMENT

Children with vestibular related impairments respond favorably to vestibular and balance therapy, tailored to their age and goals.

---

### ARTICLE

---

046c

---

**DID THIS ARTICLE  
HELP YOU?  
SUPPORT VEDA @  
VESTIBULAR.ORG**

---

5018 NE 15th Ave.  
Portland, OR 97211  
1-800-837-8428  
info@vestibular.org  
vestibular.org

# Part III: Pediatric Vestibular Disorders

## Effective Intervention or Treatment for Vestibular Related Impairments in Children

By R.M. Rine, PT, PhD and J. Braswell Christy, PT, PhD

### INTRODUCTION

When disruption of vestibular system function occurs in children it results in symptoms of **vertigo or dizziness, oscillopsia or gaze instability, and delayed development or diminished balance** and other motor abilities.<sup>1-6</sup> Children who present with these symptoms or who have a diagnosis known to potentially disrupt vestibular system function should have screening of vestibular system function by a professional who has completed specialty competency training in vestibular rehabilitation, or a comprehensive diagnostic evaluation. Based on results of screening and/or diagnostic testing, treatment, both medical and rehabilitation, should be prescribed.<sup>4,5</sup>

### MEDICAL INTERVENTION

Medical intervention for damage to the vestibular system is limited to pharmacological agents or surgical intervention as warranted, and is dependent on the actual diagnosis or causal factors.

Children with migraine should undergo complete ophthalmological testing, followed by neurological examination if vision concerns are ruled out. Treatment is directed at eliminating trigger factors (e.g. eye problems, fatigue, stress) and psychological counseling and treatment, if necessary. Simple analgesic treatments to lessen pain (e.g. paracetamol, single or combinations of anti-inflammatory drugs, aspirin) may be warranted. This therapeutic approach alone is often sufficient to diminish the frequency and intensity of crises.

In the case of **labyrinthitis**, treatment consists of obtaining a bacteriological sample, and antibiotic therapy as warranted. The objective is to avoid or minimize damage to the cochlea-vestibular complex and avoid spread of the infection (e.g. mastoiditis, facial paralysis, septicemia, meningitis and extra-petrous septic diffusion).<sup>5,6</sup>



The treatment for **cholesteatoma** is surgical and should be preceded and followed by complete cochlea-vestibular testing.

Any child with dizziness or oscillopsia following mild head trauma or concussion should have complete vestibular testing, and appropriate medical treatment as warranted.

Once the acute phase of any condition has passed, and delayed development or disruption of motor and balance abilities persist, or if Dynamic Visual Acuity tests are positive, rehabilitation is warranted and has been shown to be efficacious.<sup>3,7,13</sup>

## RECOVERY MECHANISMS

- **Habituation**
- **Adaptation**
- **Substitution**
- **Motor Learning**

## REHABILITATION

Rehabilitation to improve or alleviate the oscillopsia, dizziness or vertigo, and imbalance has been shown to be efficacious in adults.<sup>10-13</sup> Rehabilitation for children is similar to what is provided for adults, but modified for the person's age and interest. Treatment should be focused on adaptation, habituation and/or substitution depending upon diagnosis and test results.<sup>8,9,14</sup> The challenge is modification of activities to maintain interest and cooperation, and to motivate the child. All activities must be age appropriate and fun. Similar to adults, the treatment for BPPV would be repositioning and will not be elaborated upon here. The focus here will be on **hypofunction (unilateral and bilateral), irritative lesions (i.e. fistula) and central disorders**.

Mechanisms for recovery from vestibular related functional impairments (gaze stability and balance) are **habituation, adaptation, substitution and motor learning**. If the loss of vestibular function occurred at or shortly after birth, the impairments will include delayed development of the use of

vision and somatosensation for balance, and thus intervention must address enhancement of the development of these abilities, particularly for children with **bilateral hypofunction**. If the hypofunction occurs after the critical period of balance development (approximately 6 years of age)<sup>15</sup> then retraining and substitution should be sufficient, with rapid improvements seen.

Rine et al<sup>8</sup> reported that children with **bilateral vestibular hypofunction** had significantly improved balance and motor development following intervention. Children participated in a 12-week exercise intervention focused on substitution and habituation, three times weekly, 30 minutes per session, under the direction of a physical therapist. The progressive motor development delay was halted, and balance improved.

Braswell and Rine<sup>7</sup> also reported improved scores on measures gaze stability following 6 weeks of gaze stabilization training adapted for children done 3 times per week, 20 minutes per session.

D'Agostino, Melagrana and Taborelli<sup>16</sup> reported a case of **horizontal canal BPPV** in a 10-year-old child, with 'spontaneous' recovery following short term hospitalization and repeated mobilization (e.g. roll side-to-side) in supine.

Balance and habituation training activities must be modified to the child's level of cognitive maturation and interest, with particular consideration to the caregiver.

Unlike adults, the child is dependent upon parents, caregivers and therapists to carry out the program and assure compliance. Therefore, the use of toys, games, and other items to facilitate visual tracking, or the use of swings to provide movement during visual stabilization activities, is important to maximize the child's participation and cooperation.

Instead of letters, which are not motivating or fun, line pictures, moving balls, or animals with symbols or letters may be used during visual stabilization training.

This cooperation and effort is critical to the effectiveness of the exercise regimen.

Typically, when acute symptoms have subsided and appropriate medical treatment is rendered (e.g. surgery to repair fistula), children are eager to resume play and other age appropriate activities. It is critical to monitor progress and provide short



term, daily training to be carried out at home with caregivers (e.g. visual tracking exercises, visual stabilization regime, balance and movement activities to resume age appropriate levels of activity).<sup>9,14</sup>



## REHABILITATION FOR CENTRAL DISORDERS

Although reports of vestibular deficits of central nervous system origin in children are rare, reports in the literature do note:

- Children with **learning disabilities present with sensory organization and balance deficits**<sup>17</sup>, and
- Balance deficits are evident in children with **cerebral palsy**, and vestibular rehabilitation does improve motor and visual abilities in children with **central nervous system deficit, autism**, and **low birth weight premature infants**.<sup>18-22</sup>

Treatment can be developed to either facilitate the use and integration of systems intact but not used, or to facilitate compensatory mechanisms. For example, a child with **hypertonicity** and developmental delay, as well as evidence of visual stability and balance problems, should participate in programs that include facilitation and improvement of visual stabilization, movement tolerance and balancing during visual stabilization, and balance training under varying environments. Habituation, gaze stabilization, and balance and vision therapy may also be efficacious to improve symptoms of dizziness and balance problems in children with **concussion**.<sup>23</sup>

## CONCLUSION

In summary, children with vestibular related impairments respond favorably to vestibular and

balance therapy, tailored to their age and goals. Vestibular deficits may be peripheral or central in nature, and if peripheral, may include disruption of one or both sides (uni- and bilateral vestibular hypofunction, respectively). Comprehensive testing of signs and symptoms is critical for appropriate diagnosis, which is critical to the identification and implementation of appropriate rehabilitative and medical interventions. Rehabilitation programs should be based on appropriate diagnosis, and evaluation and interventions should be completed by a therapist who has successfully completed competency training.

## REFERENCES

1. Braswell J, Rine RM. Evidence that vestibular hypofunction affects reading acuity in children. *International Journal of Pediatric Otorhinolaryngology*. 2006. 70:1957-1965.
2. Epidemiology of Dizziness and Balance Problems in U.S. Children: Results from the 2012 National Health Interview Survey (NHIS). Association for Research in Otorhinolaryngology. Annual Conference; 14 Feb; 2014.
3. Rine RM, Wiener-Vacher S. Evaluation and treatment of vestibular dysfunction in children. *NeuroRehabilitation*. 2013. 32:3:507-518.
4. Wiener-Vacher SR, Amanou L, Denise P, Nancy P, Manach Y. Vestibular function in children with the CHARGE association. *Archives of Otolaryngology Head and Neck Surgery*. 1999. 125:342-347.
5. Wiener-Vacher SR. Vestibular disorders in children. *International Journal of Audiology*. 2008. 47:578-583.
6. Wiener-Vacher SR, Obeid R, Abou-Elew M. Vestibular impairment after bacterial meningitis delays infant posturomotor development. *J Pediatrics*. 2012. 161;2:246-251.
7. Braswell J, Rine RM. Preliminary evidence of improved gaze stability following exercise in two children with vestibular hypofunction. *International Journal of Pediatric Otorhinolaryngology*. 2006. 70:1967-1973.
8. Rine RM, Braswell J, Fisher D, Joyce K, Kalar K, Shaffer M. Improvement of motor development and postural control following intervention in children with sensorineural hearing loss and vestibular impairment. *Internat J Ped Otorhinolaryng*. 2004. 68;9:1141-1148.
9. Rine RM, Dannenbaum E, Szabo J. Section on Pediatrics knowledge translation lecture: Pediatric Vestibular Related Impairments. *Pediatr Phys Ther*. 2016. 28:2-6.



10. Schubert MC, Migliaccio AA, Clendaniel RA, Allak A, Carey JP. Mechanism of dynamic visual acuity recovery with vestibular rehabilitation. *Archives Phys Med Rehabil.* 2008. 9;3:500-507.
11. Herdman SJ, Clendaniel RA, Mattox DE, Holiday MJ, Niparto JK. Vestibular adaptation exercises and recovery: acute stage after acoustic neuroma resection. *Otolaryngol Head Neck Surg.* 1995. 113;77:87.
12. Herdman SJ, Schubert MC, Das VE, Tusa RJ. Recovery of dynamic visual acuity in unilateral vestibular hypofunction. *Otolaryngology Head and Neck Surgery.* 2003. 129;8:819-824.
13. Herdman SJ, Hall CD, Schubert MC, Das VE, Tusa RJ. Recovery of dynamic visual acuity in bilateral vestibular hypofunction. *Arch Otolaryngol Head Neck Surg.* 2007. 133;4:383-389.
14. Rine RM, Christy JB. Evaluation and Treatment of Vestibular Function and Related Postural Control and Gaze Stability Impairments in Children. In: Herdman SJ, Clendaniel R, eds. *Vestibular Rehabilitation.* 4th ed. Philadelphia: F.A. Davis; 2014.
15. Rine RM, Spielholz NI, Buchman C. Postural control in children with sensorineural hearing loss and vestibular hypofunction: deficits in sensory system effectiveness and vestibulospinal function. In: Duysens j, Smits-Engelsman BCM, Kingma H, eds. *Control of Posture and Gait.* Amsterdam: Springer-Verlag; 2001;40-45.
16. D'Agostino R, Melagrana A, Taborelli G. Benign positional paroxysmal vertigo of horizontal semicircular canal in the child: case report. *International Journal of Pediatric Otorhinolaryngology.* 2003. 67:549-551.
17. Liao HF, Jeng SF, Lai JS, Cheng CK, Hu MH. The relation between standing balance and walking function in children with spastic diplegic cerebral palsy. *Developmental Medicine & Child Neurology.* 1997. 39:106-112.
18. Gregg CL, Haffner ME, Korner AF. The relative efficacy of vestibular-proprioceptive stimulation and the upright position in enhancing visual pursuit in neonates. *Child Development.* 1997. 309-314.
19. Horak FB, Shumway-Cook A, Crowe TK, Black FO. Vestibular function and motor proficiency of children with impaired hearing or with learning disability and motor impairments. *Developmental Medicine Child Neurology.* 1988. 30:64-79.
20. Lowes PL. An evaluation of the standing balance of children with cerebral palsy and the tools for assessment [ Medical College of Pennsylvania and Hahnemann University; 1996.
21. Slavik BA, Kitsawa-Lowe J, Danner PT, Green J, Ayres AJ. Vestibular stimulation and eye contact in autistic children. *Neuropediatrics.* 1984. 15:33-36.
22. Wincent MM, Engel JM. Vestibular-proprioceptive abilities in children experiencing recurrent headaches. *Phys and Occup Ther in Ped.* 1994. 14;2:63-65.
23. Hoffer ME, Schubert MC, Balaban CD. Early diagnosis and treatment of traumatic vestibulopathy and postconcussive dizziness. *Neurology Clinics.* 2015. 33;3:661-668.

---

©2016 Vestibular Disorders Association  
 VeDA's publications are protected under copyright.  
 For more information, see our permissions guide at  
[vestibular.org](http://vestibular.org). ***This document is not intended as a  
 substitute for professional health care.***



