

# Should balance performance be part of clinical evaluation of children with MEE?

**Ewa Raglan**  
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# FACTS and FIGURES

- OM & MEE: most common causes of vestibular disturbances in children?  
(Gates 1980  
Busis SN 1983,1988  
Blayney et al 1984  
Balkany et al 1986  
Bower et al 1995  
Casselbrandt et al 1995)
- ET dysfunction and MEE and occurrence of dizziness in children  
(Blayney et al,1984)
- OM commonest disease in childhood, affects 30% of children between 2-4 years  
(Tos et al 1979)

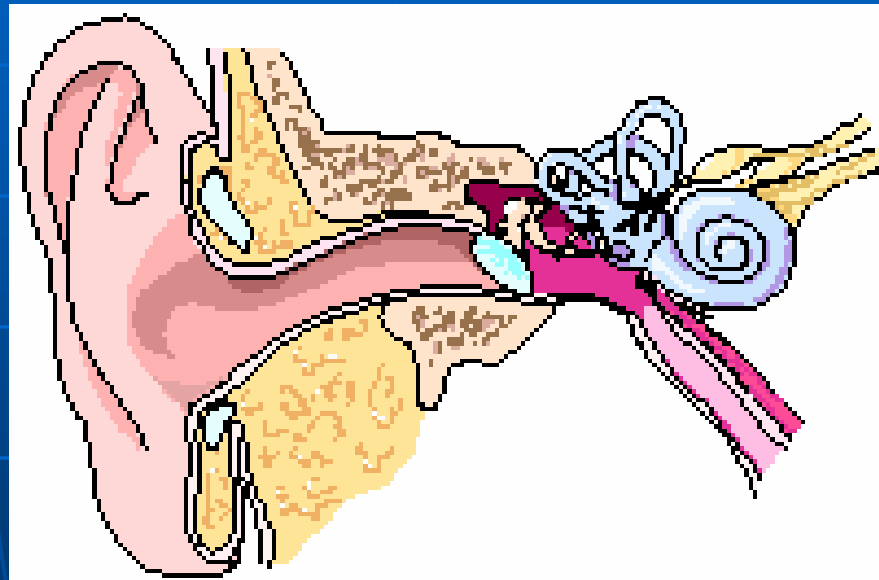
# Symptoms reported by parents

- Clumsiness, awkwardness, frequent falling

(Bluestone et al 1988, Busis SN 1991, Grace et al 1990)

- Impact on balance?
- Possible long term consequences?  
(delay in development of motor function and achievement of motor milestones)

# Middle ear and Eustachian Tube



# Possible mechanisms of effect of OME on balance?

- Ion transfer through the semi-permeable round window membrane alters composition of the endolymph via the perilymph, leading to changes in ionic channels of the kinocilia and stereocilia

(Goycoolea et al 1980)

- Serous/toxic labyrinthitis secondary to infection in a fluid filled middle ear

(Goycoolea 1988)

- Negative pressure changes in the middle ear transmitted through the labyrinthine windows leading to secondary movement of the inner ear fluids

(Kobrak 1935, Carlborg et al 1992)

# How balance has been assessed: tests

- ENG - record of eye movements to look at the SN and induced nystagmus by rotatory positional caloric testing.  
Observation of gain (SCV/head velocity =1.0), phase (offset in the timing of eye movement relative to head movement =180°), symmetry
- Posturography assess patient's reliance on sensory inputs and shows motor responses elicited to maintain balance when the floor moves
- Developmental testing (Peabody developmental Motor Scale) gross and fine motor skills from birth to 83 months  
(Folio and Fewell 1983)
- Bruininsky-Oseretsky test for Motor proficiency - standardised test for motor function for 4.5 -14.5 years  
(Bruininsky 1987)
- Parental symptoms questionnaire



# Studies in children with OME

<i>Authors</i>	<i>No. of children</i>	<i>Age</i>	<i>Tests + Results</i>		
Merica, 1942	135	Vertigo	Caused by obstruction of ET		
Snashall, 1987	50%	children	50% children with SOM had some balance difficulties		
Denning + Mayberry, 1987	18 sub (=OME 6+) 17 normal)	4-5 yrs	Stepping test	72% vs 18% (P<0.001)	Vertical writing 67% vs 24% (p<0.01)
Cohen et al, 1997	25 sub (19 bil, 6 uni) Controls	3-4 yrs + OME	Developmental scale (PDMS)	Subj. (bil not uni) vs controls are delayed in development of motor skills	Worse sig. scores on balance & locomotion
Casselbrandt, 1998	11 sub + 11 controls	3-9 yrs + OME	Postural sway effect of moving visual environment (sig diff sub vs controls)	Increased reliance on other non-vestibular cues to maintain balance	In OME increased postural sway in response to moving visual scenes

# Balance studies pre and post Grommet insertion using ENG

<i>Authors</i>	<i>No. of children</i>	<i>Age (yrs)</i>	<i>Condition</i>	<i>Test</i>	<i>Results</i>	<i>Comments</i>
Golz et al, 1991	50+50	4-7	Bil OME	ENG (SN&PN)	Ab 71% N 4%	Correlation between abn. ENG and subjective balance disturbance  Post Grommets: 99% better
Koyuncu et al, 1999	15+15	8-13	OME	ENG (SN,PN) + Rhomberg	Ab 10% 0 controls	Post grommets - all better

# Balance studies pre and post Grommet insertion (posturography)

<i>Authors</i>	<i>No. of children</i>	<i>Age (yrs)</i>	<i>Condition</i>	<i>Posturogr . results</i>	<i>Comment s</i>	<i>After grommets</i>
Casselbrandt et al, 1983	9	4-9	Rc or persistent MEE	Vision/ propor eliminated  2 children with uni MEE lost balance		No balance problems
Casselbrandt et al, 1995	41 50 N	3-12	OME	Higher velocity of sway, 63% children fell during test	8% normal children fell	22 decreased sway Sig diff in proportion of child falling pre& post
Jones et al, 1990	34 34 controls	3-5	Chronic OME	Body sway greater sig.in OME (p<0.05)		4 months later – no difference in sway between 2 groups

# Balance studies pre and post Grommet PDMS-GM and BOTMP pre/post

Orlin et al, 1997	13 12 controls	24-60 mths	OME  PDMS- GM	Reduced scores sig In OME(p<0.0 5)	Higher scores in OME = accelerating rate of the development	
Hart et al, 1998	19 14 matched controls	4-6 yrs	Chronic OME	PDMS/ BOTMP	Sig. lower performance for OM group	Great improvement
Golz et al, 1998	136 74 controls	4-9 yrs	OME	ENG + BOTMP parental questionnaire	ENG 58% pathological, (4% contr) low scores on BOTMP	Symptoms resolved in 96% of 77 children, findings on tests resolved(1/1 2 later)

# Long term effects

- Casselbrandt et al, 2000: 71 children (4 yrs old), well documented middle ear history since early infancy. Tests: rotational test, posturography = [tested effusion free]
- 40 + history of OME since early infancy
- 31 - no history of OME ... those children had lower gain to rotation at 0.1 Hz at 150 deg/sec ( $p=0.007$ ), no difference in posturography between the groups
- These results suggest that a history of recurrent/persistent MEE affects vestibular/ balance function in children when tested in absence of concurrent episode of MEE, which may have developmental consequences

# Conclusion: effects of OME

- OME affects the balance/vestibular system at a time of MEE
- May delay motor coordination skills (walking)
- Children with MEE are more reliant on visual cues than on vestibular/proprioception to maintain balance
- The visual sensitivity for balance may be indicative of reduction or disregard to vestibular function
- In those children, play may simulate moving visual surrounds which could create misleading visual information leading to:
  - sensory conflict which in turn forces the postural control system to increase reliance on proprioception and the vestibular system to maintain balance
  - Adaptive strategies may fail and child may become clumsy and more prone to accidents and falls
- **Both hearing AND balance disturbance should be considered in management of OME**

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