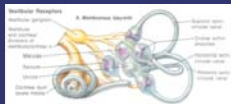


Vestibular Definition



◆ Physiological

- Canals and otoliths of inner ear
- Diagnostic tests



◆ Functional

- Vestibular ocular reflex (VOR) – gaze stabilization
 - Correct retinal slip
- Vestibulospinal (Vsp) – postural control/balance

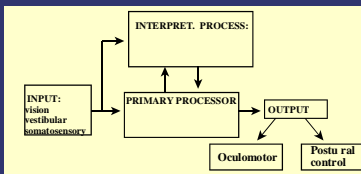
distinct end organ input to gaze and balance

Vestibular Definition (continued)



Multi-modal dependency for function

- Vestibular, vision and somatosensation
- Central processing of information
- Motor system required



Vestibular Defined



- ◆ The vestibular system transduces and processes
 - Angular and linear acceleration and deceleration of head
 - Enables balance, locomotor control and gaze stability
- ◆ An inertial guidance system
 - Integrated into a complex multi-sensory interplay between the central nervous system, *eye, inner ear and somatosensory inputs*

Measure must include VOR and Vsp, with control for other contributions. Measure should consider central processing.

Identification of Measures



- ♦ 33 tests identified and reviewed
 - 6 screened out due to:
 - Self report, high cost, expertise required
- ♦ In-depth review of 27 tests
 - Categorized by VOR vs. Vsp
 - Eliminated for lack of reliability, sensitivity, or cost
- ♦ Selected
 - Dynamic visual acuity – tests VOR
 - Vestibular and sensory interaction for balance – tests Vsp
 - VOR suppression – central test

Dynamic Visual Acuity (DVA)



- ♦ DVA - quantify acuity change with head stable vs. moving
 - Typically the same, unless vestibular deficit
- ♦ Test requirements:
 - Optotype visible ≥ 80 msec
 - Visual contribution controlled (via head movement rate)
- ♦ Computerized version optimal: reduce training and assure requirements
- ♦ NO PEDIATRIC VERSION developed to date

Vestibular & Sensory Interaction for Balance



- ♦ Quantify sway in varying vision and support surface conditions, to differentiate roles of sensory inputs
 - Must control for other inputs
 - Posturography = gold standard: costly, skill
- ♦ Current clinical versions
 - Sway not measured, require training and skill
 - Consistent method for use with children and adults NOT available

Development:



- ♦ Coordination with vision and motor teams
 - 1 tool, 2 measures achieved
 - Static acuity and balance
- ♦ Development phases:
 - I: develop tool (*in progress*)
 - II: determine reliability and validity (*November - Feb*)
 - III: develop instructions for use in Toolbox (*Dec - March*)

DVA Development

lead = M Schubert, Ph.D. (Dale Roberts)



- ♦ Computerized version
 - Minimize cost and language and cultural effects
- ♦ Software and hardware
 - Subject to identify optotype with head stable and moving @ specified rate
 - Progressively smaller size
- ♦ Compare:
 - Symbol vs. letter results
 - Test for young child and others
- ♦ Reliability and validity
- ♦ Instructions



Computerized DVA



- ♦ Test/retest: 110 subjects without pathology:
 - 3-7 y.o. n = 20
 - 7.1-15 y.o. n = 30
 - 20-79 y.o. n = 10 in each decade
- ♦ Test subjects with pathology (rotary testing): 10 each children, adults
- ♦ Test with letter & symbols (all with pathology; typical n = 10 8-15 y.o.; n = 20 adults)
- ♦ Compare to previous versions



DVA score = static – active, in logMAR

Development of Balance test: lead: Susan Whitney, Ph.D. (Mark Redfern)



- ◆ Coordination with motor team
 - 1 tool, 2 measures achieved
- ◆ Development phases:
 - I: develop tool (*in progress*)
 - II: determine reliability and validity (*November – March 2009*)
 - III: develop instructions for use in Toolbox and report

Balance Test Development



- ◆ Quantify sway under varying sensory conditions across life span
 - Foam, SLS/DLS, EO/EC
- ◆ Establish validity with gold standard of test for sensory integration for balance (posturography)




Balance Development : *Vestibular and Sensory Interaction for Balance Test*




- ◆ Phase 1:
 - Hardware /software
 - Accelerometers (how, where to attach)
 - Data acquisition and processing methods, software user interface
 - Subject to stand, up to 30 sec, in 4 sensory conditions (EO/EC, foam/floor), for each of 2 support conditions (DLS, SLS)



Progress/plan for Vestibular Team 


- ♦ **October 2008 – March 2009 (Phases I and II)**
 - Complete test protocol, hardware and software development
 - Complete testing of all subjects to establish feasibility, reliability and validity
 - Preliminary analysis of data
- ♦ **February – May (Phase III)**
 - Development of tool completed, reports done, ready for norming
 - Training materials completed

 **NIH Toolbox**
Assessment of Neurological and Behavioral Function

Vestibular

Rose Marie Rine, P.T., Ph.D.
University of North Florida

October 27, 2008

 For more information, please visit www.nihtoolbox.org
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