MOVEMENT SYSTEM DIAGNOSES
NEUROMUSCULAR CONDITIONS

Diagnosis Descriptions

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DIAGNOSIS DESCRIPTION: MOVEMENT PATTERN COORDINATION DEFICIT

The primary movement dysfunction is the inability to coordinate an intersegmental task because of a deficit in timing and sequencing of one segment in relationship to another. The movement dysfunction in the lower extremity is primarily observed during postural control tasks and in the upper extremity during in hand manipulation and grasp and release of different objects coupled with reach. Motor performance typically improves with practice and instruction.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: • Stroke (mild) • Multiple Sclerosis (remitting) • Parkinson's Disease (mild) • Generalized debilitation • Multi-sensory gait/balance disturbance • s/p LE surgery • BPPV with postural instability ◎ Down Syndrome ◎ Mental Retardation ◎ Prenatal Drug/Alcohol Exposure ◎ Developmental Coordination Disorder ◎ Autism Spectrum Disorder ◎ Prematurity ◎ Developmental Delay ◎ Fragile X ◎ Idiopathic Toe Walker ◎ Motor Apraxia Pt / Caregiver May Report: • Feels unsteady; possible fall • Fear of falling ◎ Clumsiness ◎ Occasional falls	Task Analysis: *Sit to Stand:* • Altered sequence of movement components during execution (usually insufficient DF of leg over foot) • Posterior sway at ankle and may step at termination • Unlikely to require significant physical assistance *Additional Transitional Mvts:* ◎ Altered sequence, instability, and lack of fluidity when executing transitional movements appropriate to age (or adjusted age) *Gait:* • Variable foot placement or line of progression or may be guarded with slow, small steps • Assistance for balance *Jump, Run, Skip and other advanced motor skills:* ◎ Altered sequence,	Movement: • Generally fractionated movement against gravity throughout Muscle Tone: • Normal or mild hyperexcitability, mild hypotonicity or mild rigidity • Grades of 0-2 on modified Ashworth Sensation: • Normal or no more than mild loss of JPS at great toe or ankle in LE • Normal or no more than mild loss of sharp/dull or numbness in UE Non-equilibrium Coordination: • Normal or mild (to moderate) ataxia with reciprocal and synergistic movement • Normal or mild ataxia with tests of accuracy	• Force Production Deficit • Sensory Selection and Weighting Deficit • Sensory Detection Deficit • Dysmetria	• Stable with standing ADL tasks • Independent ambulation in home and community (at least in familiar environments) • Ambulate without device or with cane at most; may need an AFO but unlikely • Ascend/descend stairs reciprocally • Gait speed at least 75% of normal for age

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Delay in fine motor tasks Overly messy when eating and dressing Started walking later than other children Awkward compared to peers Poor performance in sports activities	instability, and/or lack of fluidity May need assistance for balance *Reach and grasp:* • Slowed or awkward • Difficulty adjusting grip during transport of objects • Difficulty controlling force relative to task demands Lack of age appropriate grasp <u>Postural Control</u>: • Increased latency in postural movement patterns and/or • Inappropriate amplitude of postural adjustments or responses • Increased posterior sway during stance activities			

DIAGNOSIS DESCRIPTION: FORCE PRODUCTION DEFICIT

The primary movement fault is weakness. The origin of the weakness may be muscle, neuromuscular junction, peripheral nerve, or central nervous system dysfunction. The presentation may be focal (one joint), segmental (generalized to an extremity or body region), or related to fatigue (of skeletal muscle rather than cardiopulmonary capacity).

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: Good potential for Impairment Recovery: • Generalized debilitation • Disuse atrophy • Peripheral nerve contusion • Guillian Barre Syndrome • Stroke (mild) • Brain injury • Multiple Sclerosis (remitting) • Prematurity • Developmental Delay • Down Syndrome • Fragile X • CP (mild) • Transverse Myelitis • Hypotonia Poor potential for Impairment Recovery: • Stroke • Brain Injury • Multiple Sclerosis (primary or secondary progressive) • Chronic Inflammatory Diffuse Polyneuropathy • Myopathies • Muscular Dystrophies • Spinal Cord Injury (low	Strength: • Less than 3+/5 to 4/5 muscle strength throughout a limb or limbs or • Difficulty moving through full range against gravity or • Focal weakness at one primary joint or • Deterioration in range of motion/speed of movement with repetition Task Analysis: *Prone on elbows*: • Unable to maintain head at 90 degrees when age appropriate *Pull to sit:* • Maintains head lag after age appropriate *Floor to stand* • Exhibits a + Gower's sign or requires use of UEs via ½ kneel after age appropriate *Sit to Stand:* • Failure during initiation phase typically requiring assistance or accommodation • Extension of knees before	Movement: • Fractionated if present Muscle Tone: • Normal or mild hyperexcitability, mild hypotonicity or flaccid, mild rigidity • Grades 0-2 on the modified Ashworth Sensation: • Normal or no more than mild loss of joint position sense at ankle, loss of sharp/dull, or numbness Non-equilibrium Coordination: • In more severe forms may be unable to test due to weakness • In milder forms, likely to be slow but accurate Postural Control: • In early stages of recovery, unable to sit or perhaps stand unsupported; would fall without support	• Movement Pattern Coordination Deficit • Hypokinesia	Good potential for Impairment Recovery: • Stable with standing ADL tasks • Independent ambulation in home and community (at least in familiar environments) • Ambulate without device or with cane at most (may need AFO) • Ascend/descend stairs reciprocally; may need railing for balance/support • Gait speed at least 60-80% of normal for age • Able to use hand in all functional tasks • With nervous system problems, may reach a plateau in improvement in strength and notice ongoing difficulties with musculoskeletal fatigue, power, and speed Poor potential for Impairment Recovery: • Varies with degree of involvement • In all but most severe forms, improved independence with

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
ASIA A or B paraplegia) • Polio/post-polio syndrome ? Cerebral Palsy Myelomeningocele Hypotonia <u>Pt / Caregiver May Report</u>: • Increased need for caregiver assistance • Fatigue History of prematurity Delay in acquisition of motor milestones appropriate for age	hips during first half of execution *Gait:* • May need manual assistance or a device to bear weight and maintain upright • Deviations are often significant • In severe forms will be unable to attempt ambulation *Reach and Grasp:* • Difficulty or failure with reach above 60° shoulder flexion and/or with sustaining reach position • Unable to maintain force for gripping objects especially during transport Unable to bring arms to midline in supine when age appropriate Unable to hold bottle in sitting <u>Postural Control</u>: • Unable to stand unsupported or loss of support moment at hip and knee during single limb support • Limited improvement in performance with practice; may worsen with repeated trials • In more severe forms may be unable to sit unsupported			functional activities using compensatory movement strategies but may still require assistance • Use of wheelchair at least for distances likely; degree of independence with wheelchair mobility relative to involved extremities • In less severe form, ambulate short distances with device and/or bracing and/or physical assistance at very slow speeds • Able to use hand as an assist with activity in less involved forms • In more severe forms requires 24 hour care

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DIAGNOSIS DESCRIPTION: FRACTIONATED MOVEMENT DEFICIT

The primary movement dysfunction is the inability to fractionate movement associated with moderate or greater hyperexcitability. May describe the upper or lower extremity or both. Always associated with central neurological deficit.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: • Stroke • Brain Injury/hypoxia • Spinal Cord Injury (ASIA C or D) • Multiple Sclerosis • Intraventricular Hemorrhage (IVH) • Periventricular Luekomalacia (PVL) • Brain Tumor • Meningitis • CP/static encephalopathy Pt / Caregivers May Report: • Stiffness of the limbs and/or pain • Complicated perinatal history, ie documented PVL, IVH, hypoxic ischemic event	Movement: • Unable to fractionate movement • Slow; unable to make rapid reversals in movement • Unable to generate force rapidly Muscle Tone: • Moderate or greater hyperexcitability • Grade 3 or 4 on the modified Ashworth Reflex Testing: • May exhibit +ATNR, +STNR Task Analysis: • Consistent non-fractionated movement pattern across multiple tasks	Task Analysis: *Pull to sit:* • Neck hyperextension with shoulder elevation • May exhibit LE extension, adduction, and hip medial rotation (LE extensor pattern) *Prone on elbows:* • Neck hyperextension with shoulder elevation *Floor to stand:* • Pulls up with UEs with Les extended; unable to fractionate or dissociate LE movements *Sit to Stand:* • Stiffness of involved limbs • Slow • No dissociation of movement at one joint from movement at another • May see associated reactions with increased effort • In forms with less anti-gravity movement, unable to stand	• Force Production Deficit	• Related to degree of antigravity movement • In forms with more antigravity movement, stability in sitting and with reaching; ambulation in home and community with significant deviations and significant reduction in speed with or without a cane; ascend/descend stairs step-to with or without a railing • In forms with 4 limb involvement wheelchair for locomotion (probably electric) • Able to use UE as “assist” with ADL

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Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
		Creeping: • May exhibit bunny hopping or commando crawling rather than assuming a 4-point position *Gait:* • Compensatory movement strategy of hip hiking, vaulting, or circumduction to initiate swing of involved extremities • Stiffness of hip/knee flexion during swing • Scissoring • "toe walking" or "equinus gait" • Hip and knee often flexed during stance of involved extremities • Likely to require AFO to control foot position for weight bearing • Likely to require assistive device at least early in course • In forms with less anti-gravity movement, unable to stand *Reach and Grasp:* • Able to reach in very limited range(< 60-90°) • Hand closure with minimal relaxation or minimal opening • Finger flexion associated with wrist flexion and		

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
		pronation <u>Postural Control:</u> • In forms with more antigravity movement, able to sit unsupported but asymmetrically or with posterior pelvic tilt (sacral sitting) and hip medial rotation with compensatory thoracic flexion • Stability may improve with practice but symmetry will not		

DIAGNOSIS DESCRIPTION: POSTURAL VERTICAL DEFICIT

The primary movement dysfunction is inaccurate perception of vertical orientation resulting in postural control deficits and the tendency to **resist correction of center of mass alignment**. The condition may be in the medial/lateral or anterior/posterior direction.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: • Stroke (med/lat) • Brain Injury (med/lat) • Psychomotor Disadaptation Syndrome (ant/post) • Backward Disequilibrium (ant/post) • Rhett's Syndrome Pt / Caregiver May Report: • Backward falls • Fear of falling • Visual or visual perceptual deficits	Postural Control: • Shifts center of mass beyond limits of stability to side or backward without weight acceptance • **Resists correction or becomes fearful/agitated when center of mass alignment is corrected** • Deficits may present in sitting, standing, or with walking depending on severity Perception: • Sensation of "falling" when shifted toward correct vertical alignment • May have disregard or neglect of involved extremities	Movement: • Presentation is variable although movement in at least 60% of muscle groups in the LE is expected • Movement may not be fractionated Motor Planning: • May have difficulty planning or organizing movement patterns into purposeful actions Sensation: • Likely to be impaired to light touch and joint position sense (med/lat) Behavior: • Impulsive • Poor judgment • Fear avoidance behavior such as clutching or grabbing with UE and shifting base of support	• Sensory Selection and Weighting Deficit • Sensory Detection Deficit • Fractionated Movement Deficit • Force Production Deficit	• Related to severity of behavioral/cognitive deficits, motor function, and natural recovery of perceptual deficit • Assisted ambulation with uncomplicated devices such as wheeled walker or along a wall • Many are non-ambulatory and require significant assistance with transfers

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DIAGNOSIS DESCRIPTION: SENSORY SELECTION AND WEIGHTING DEFICIT

The primary movement dysfunction is the inability to initiate or maintain postural orientation or motor performance as a result of decreased ability to screen for and attend to appropriate sensory inputs. Patients may demonstrate sensory seeking or sensory avoidance behaviors. Patients in this diagnosis have sensory issues as their primary movement system problem.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: • Stroke • Brain Injury • Unilateral vestibular hypofunction • Bilateral vestibular hypofunction • BPPV with postural instability • Persistent Postural-Perceptual Dizziness • Space and Motion Sensitivity • Sensory Integration • Autism Spectrum Disorder • Pervasive Developmental Disorder • Rhett's Syndrome • Asperger's Syndrome • Sensory Processing Disorder Pt / Caregiver May Report: • Symptoms when riding in a car, when walking along patterned walkways, or in visually stimulating environments • Repetitive non-purposeful movements • Impaired social behaviors • Aversion to a variety of sensory stimuli	Task Analysis: *Gait:* • Deviation in line of progression to one or both sides • Instability with head turning *Turning Around:* • Loss of balance or increased ankle or hip sway at termination • Worse with faster movement • Dizzy Postural Control: • Able to stand unsupported but may require practice • Increased sway or instability with eyes closed or other change in sensory conditions • May demonstrate hip strategy during static standing tasks • Postural responses may be delayed or exaggerated; exaggerated responses lead to postural instability • May improve with modification of sensory needs and practice, instruction and	Movement: • Fractionated Non-equilibrium Coordination: • Intact Head Thrust Test: • May be positive Dynamic Visual Acuity: • May be positive Sensation/Sensory Behavior: • May show signs of gaze aversion • May show signs of self stimulation behaviors such as rocking, spinning and banging	• Movement Pattern Coordination Deficit • Postural Vertical Deficit • Sensory Detection Deficit	• Ambulation with straight line of progression and no loss of balance in all regular sensory environments • May have decreased tolerance to prolonged exposure to highly visually stimulating environments • May have symptoms with head/body turning tasks with mild to no instability

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
• Delayed acquisition of motor milestones appropriate for age	encouragement <u>Dizziness</u>: • Dizziness associated with head turning <u>Sensory Sensitivity</u>: • Symptoms with smooth pursuit and/or saccadic eye movement or in situations with visual motion cues. • Symptoms with transitions from one sensory environment to another			

DIAGNOSIS DESCRIPTION: SENSORY DETECTION DEFICIT

The primary movement dysfunction is the inability to execute intersegmental movement due to lack of joint position sense or multi-sensory failure affecting joint position sense, vision, and/or the vestibular system. May involve UE, LE, or both. Patients in this diagnosis have loss of joint position sense as their primary movement system problem.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
Associated Conditions: • Stroke • Brain Injury • Incomplete spinal cord injury (ASIA C or D) • Peripheral polyneuropathy • Multi-system failure • Bilateral vestibular loss Pt / Caregiver May Report: • Unable to stand still • Exposure to vincristine for childhood cancer • Child trips while walking; unable to run • Can hear child walking due to foot slap	Sensation: • Moderate to severe impairment of joint position sense • Mild or greater loss of joint position sense and touch sensation of one or both UEs Task Analysis: *Sit to Stand:* • Failure during the execution phase with hyperextension of the knee(s) before hip extension, instability of the ankle, and/or stepping to alter base of support *Gait:* • Variation in foot placement, hyperextension of the knee during stance, loss of eccentric ankle control (foot slap during gait) • Requires assistance • Some improvement with visual guidance if possible *Reach and Grasp:* • Slow and dyscoordinated • Improves with visual	Movement: • Poor timing and coordination of limb movement during tasks Non-equilibrium Coordination: • Slow and clumsy • Some improvement with visual guidance	• Movement Pattern Coordination Deficit • Postural Vertical Deficit • Sensory Selection and Weighting Deficit • Force Production Deficit	• Ambulation with assistive device • Increased difficulty in conditions of poor lighting and uneven surfaces • Limited standing stability for functional tasks • Lack of hand function without visual guidance

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement System Dx	Expected Outcome
	guidance <u>Postural Control</u>: • Unable to stand unsupported or difficult • If able to stand unsupported, significant increase in sway or LOB with eyes closed • Limited improvement in performance with practice			

DIAGNOSIS DESCRIPTION: HYPOKINESIA

The primary movement dysfunction is related to slowness in initiating and executing movement. May be associated with stopping of ongoing movement.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement Dx	Expected Outcome
Associated Conditions: • Stroke • Seizure Disorder • Parkinson's Disease • Extra-pyramidal syndromes • Parkinsonism or Parkinson's Plus • Psychomotor Disadaptation Syndrome • Dementia IVH Seizure Disorder	Movement: • Able to move against gravity • Arrests in ongoing movement during functional tasks Postural Control: • Delayed timing of postural adjustments or absent postural adjustments in response to or in preparation of a movement • Loss of balance posteriorly • Inability to use appropriate postural control strategy in context Task Analysis: *Sit to Stand or Floor to Stand:* • Slow or lack of preparatory movement • Assistance with initiation • Loss of balance on termination • Unable to shift center of mass forward *Gait:* • Difficulty initiating ambulation • Often requires assistance due to arrests	Muscle Tone: • Rigid with passive movement of U/LE and/or trunk Non-equilibrium Coordination: • Undershoots movement when aimed toward a target • Slowness or arrests in reciprocal movement Reflexes: Delayed integration of early/primitive reflexes	• Force Production Deficit • Cognitive Deficit	• In milder forms may see improvement in step length and consistency of foot placement • Improvement in use of adaptive strategies in more severe forms • Likely to fall

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement Dx	Expected Outcome
	in ongoing movement • Unable to regulate step length			

DIAGNOSIS DESCRIPTION: DYSMETRIA

The primary movement dysfunction is related to the inability to grade forces appropriately for the distance and speed aspects of a task. Rapid movements are generally too large, and slow movements are generally too small for their intended purpose. Performance deteriorates with faster speeds. May involve UE, LE, or both. Generally associated with cerebellar dysfunction.

Subjective/Medical History	Key Tests and Signs	Associated Signs	Differential Movement Dx	Expected Outcome
Associated Conditions: • Stroke • Brain Injury • Cerebellar degeneration • Multiple Sclerosis • Cerebral Palsy • Agenesis of the Corpus Collusum • Fragile X • Ataxia Pt / Caregiver May Report: • Falls • Messy when eating • Is clumsy • Has frequent injuries	Non-Equilibrium Coordination: • Difficulty directing movement toward a target resulting in undershooting or overshooting • Abnormal rhythm and incoordination during rapidly alternating movements • No change with practice Movement: • Able to move against gravity • Lack of fluidity Task Analysis: • Overshooting or undershooting of targets; repeated stepping and wide base of support in standing tasks; excessive sway at trunk *Sit to Stand:* • Wide base of support; may see excessive sway at trunk; uses UE to stabilize *Reach and Grasp:* • Unable to reach to targets • Difficulty grasping small or light objects	Postural Control: • Generally able to sit with UE support; may be able to sit unsupported • Unable to stand unsupported or stands with wide base of support and high guard Task Analysis: *Gait:* • Variable foot placement in step length and step width • Generally requires assistance	• Movement Pattern Coordination Deficit • Sensory Detection Deficit	• Ambulation in home with device and perhaps bracing • May require wheelchair in community • Limited independence with UE ADL tasks with adaptive equipment

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