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## Multiple Sclerosis: Evaluation and Intervention for Patients with Mild, Moderate, and Severe Disability

Herb Karpatkin, PT, DSc, NCS, MSCS

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As a result of this course, participants will be able to:

- Develop an evaluation and treatment plan for a patient with mild disability due to MS
- Develop an evaluation and treatment plan for a patient with moderate disability due to MS
- Develop an evaluation and treatment plan for a patient with severe disability due to MS
- Develop an evaluation and treatment plan for a pediatric patient with disability due to MS
- Develop an evaluation and treatment plan for an older adult with disability due to MSS

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## Case presentations

- Mild MS disability
- Moderate MS disability
- Severe MS disability
- Pediatric MS
- Older Adults with MS

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## Characteristics of Mild MS Disability

- EDSS 0-3.0
- May be newly diagnosed
- Disability may not be readily apparent on most typical exams
- Provocative testing needed
- Treatment now may result in reduced or slower onset of disability

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## Mild MS disability

- Rarely referred to PT
- May not be aware that PT can be helpful
- PT's need to do a better job of educating regarding this
- Pts with mild MS disability often come to PT for different reasons, unaware of the current and future impact of their disease

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## Mild MS disability: Case report

### **Presenting information**

- 30-year old woman newly diagnosed with MS complains of recent difficulty finishing her daily 2-mile run.
- Comes to an outpatient PT following recently experiencing some pain in left knee and hip toward the end of the run.

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## History

- Diagnosed with the relapsing-remitting MS 3 months ago.
- Had been in USOGH when she experienced a 2-week period of numbness and tingling in her feet that worsened after prolonged exertional physical activity, on hot and humid days, or even after a hot shower.

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## History

- Primary care physician referred her to a neurologist for further examination.
- This workup included an MRI that was positive for gadolinium enhancing lesions in his cervical spine, and a lumbar puncture that was positive for oligoclonal bands

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## Medical exam (continued)

- Gaze evoked linear nystagmus
- LE DTR's 3+
- Rest of motor and sensory exam normal
- HO Numbness, tingling and LE weakness after runs
- Neurologist dxed patient with "probable MS"

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## Medical Exam (continued)

- Due to mostly normal motor exam, neurologist did not recommend PT ("you're walking fine")
- Prescribed Copaxone (Glatiramer acetate) as a disease-modifying agent
- Patient sought out PT for running related LE pain, , PCP did not think pain was related to the MS

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## Physical Therapy Exam

- Utilized measures suggested from the MSEDGE compendium-[http://www.neuropt.org/docs/ms-edge-documents/ms-edge\\_rehab\\_recs5417E23D4B53.pdf?sfvrsn=3a7e0ba1\\_2](http://www.neuropt.org/docs/ms-edge-documents/ms-edge_rehab_recs5417E23D4B53.pdf?sfvrsn=3a7e0ba1_2)
- CC- Inability to complete daily run
- Mild left posterior knee pain initially afterwards, now during run
- Tripping over toes towards the end

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## Summary of Key examination findings

### **Impairments**

- ROM- WNL but tight endfeel for (B) plantiflexion
- MMT-5/5 throughout
- Sensation- diminished light touch and proprioception in L5-S1 dermatome
- Muscle Tone- 1/5 on Modified Ashworth Scale L ankle plantiflexors, otherwise normal
- Fatigue- denied; Modified Fatigue Impact Scale (MFIS)- 11/54

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## Summary of Key examination findings

### Activity

- Berg Balance Scale (BBS) -56/56
- Dynamic Gait Index (DGI)-24/24
- Gait-Observation unremarkable,
- 6-Minute Walk Test (6MWT)- 677 meters (2221 feet)

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## PT Exam continued

- As patient reported worsening performance with fatigue, tests were repeated

### Impairment

- ROM- increased left plantiflexor endfeel tension
- MMT-left ankle dorsiflexors, knee flexors, hip flexors 4/5
- Sensation-diminished light touch and proprioception, entire LLE
- Muscle tone- Unchanged

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## PT Exam

### Functional tests

- BBS- 53/56 (score of 1 on item 14- standing unsupported on 1 foot, score of 2 on item 13- tandem stance)
- DGI-22/24- score of 1 on item 3, gait with horizontal head turns
- Gait-Observational- left foot slap and left circumduction, especially towards end of walk
- 6MWT-539 meters (1768') with multiple instances of toe catching and one LOB in last 2 minutes

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## Evaluation and Diagnosis

- Initial Exam- Unremarkable
- Fatigued exam- Multiple positive findings
- “Occult” findings in mild MS often missed unless fatigued testing is done

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## Primary problems identified

- Left plantiflexor tightness, worsening with fatigue
- LLE sensory loss worsening with fatigue
- Balance loss with fatigue-If BBS was still (-), the MBT could be used.
- Gait alterations with fatigue
- Diminished gait endurance

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## Problem 1: Intervention

- Problem: Left ankle plantarflexor tightness
- Intervention: Ankle plantarflexor stretching program. Standing or sitting ankle PF stretching. 30-60 second holds every 1-2 hours, or PRN when “toe catch” is felt

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## Rationale

- Rationale: Tightness worsening with fatigue suggests that the tightness will progress as the disease progresses.
- This will add to increased falls risk. Prolonged plantarflexion over the course of the day due to increased sitting will also increase tightness.
- Stretching throughout the course of the day could counteract this

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## Problem 2: Intervention

- Problem: LLE weakness, worsening with fatigue
- Intervention-Lower extremity strengthening exercises
- Intermittent strengthening exercises which include many sets of few repetitions with recovery breaks between sets (e.g. 10 sets of three repetitions rather than the more traditional three sets of 10).
- Low repetition, high intensity (85-90% of 1RM) exercise
- Functional strengthening of ankle dorsiflexors through functional practice of eccentric ankle dorsiflexion required during early stance phases of gait.

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## Problem 2-Intervention rationale

- LLE weakness only appears with fatigue. The fatigue-induced weakness in MS presents a problem for intervention because the fatigue prevents exercising at a high enough volume to result in improvements
- Intermittent exercise allows for greater volume by increasing the amount of rest so that fatigue never accumulates.
- Maximal Strength Training (MST) – exercise at high loads (85-90% of 1RM), for a relatively small number of repetitions and sets. This may result in greater activation of neural drive.

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## Problem 2 Intervention rationale

- The dorsiflexion weakness may be best addressed by performing dorsiflexion strengthening exercises immediately after the plantarflexor stretching, so that the increased range of motion can be used for the strengthening exercises.
- Performing the dorsiflexion exercises closed chain and in standing may also be helpful as it approximates the walking condition where the calf tightness and dorsiflexion weakness occur.

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## Problem 3: Intervention and rationale

Problem: Balance loss, worsening with fatigue

- Intervention: Balance retraining
- Task-specific practice of balance components with which the patient has difficulty: balancing with reduced base of support (i.e. BBS items 13 and 14), and balanced walking with horizontal head turns (i.e. DGI item 3).
- Alter the amount of fatigue (induced through other physical activities) to scale the level of difficulty for appropriate dosing

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## Problem 3: Intervention Rationale

- Balance loss during fatigue suggests that balance exercises should be performed when fatigued as well.
- Practicing the activities that result in balance loss when the patient is already somewhat fatigued is indicated.

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## Problem 3 rationale (continued)

- Example: have the patient walk for 6 minutes, then immediately practice the difficult balance tasks.
- A good general guideline is that if the patient can perform the task successfully, but with some, difficulty the level of fatigue is sufficient.
- If the task can be performed easily the fatigue is insufficient.
- If the patient is unable to perform the task at all the fatigue is excessive.

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## Problem 4: Intervention and rationale

- Problem 4: Altered gait, and diminished walking/running endurance
- Intervention: Intermittent, task-specific practice of walking/running with a focus on quality (i.e. repeated short duration activity separated by rest periods)
- Address relevant impairments (e.g. deficits in strength and flexibility)

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## Problem 4- Intervention rationale

- Similarly to strength training, the problem of improving gait and walking endurance in people with MS may be difficult, as having the patient walk longer and longer distances while fatigue is increasing means that the longer the patient walks, the worse the gait will become.
- Improving other impairments (e.g. ankle dorsiflexion range and strength) will help some deviations seen in fatigued gait, but will probably not improve walking endurance

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## Problem 4- Rationale (continued)

- To improve endurance, a certain amount of volume must be performed, and MS-related fatigue prevents this from happening.
- Intermittent training, where the patient takes breaks at predetermined times during a walk or run, can allow the patient to increase volume without increasing fatigue.

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## Chapter 3

Moderate MS Disability

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### **Characteristics of Moderate MS disability**

- EDSS 3.5-6.5
- Disability readily apparent, but may not have profound effect on life or work
- More multifaceted aspects of the disease become apparent

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## Moderate MS disability

- Often first point of referral to PT
- Accumulated and progressive disability at first point of contact
- Disease has been active for a prolonged period of time- decreased viable substrate for rehabilitation
- May have exercise program from someone without MS experience

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## Measures for Moderate disability

- Fatigue scales-FIS for overall impact and VAS for immediate impact
- BBS and DGI- for falls risk and identification of specific task limitations
- 6MWT- endurance- total distance and minute by minute
- 12 Item MS walking scale- self report measure

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## Case study- moderate impairment

- L.S. is a 60 year old woman diagnosed with multiple sclerosis (MS) 20 years ago. She complains of increased difficulty walking, especially outdoors, which limits her ability to go shopping independently.
- **Patient Goal:** To be able to walk outdoors and go shopping

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## Examination

- Based on L.S.'s complaints of difficulty with walking:
  - the 12-Item MS Walking Scale (MSWS-12)
    - The MSWS-12 rates the impact of MS on the patient's ability to walk.
  - Dynamic Gait Index (DGI)
    - DGI measures balance and fall risk, particularly in response to increasing task complexity during walking
  - 6 minute walk test(6MWT)
    - Measure of gait endurance

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## Impairments

MMT	Left	Right
Hip extension	3/5	3/5
Hip flexion	3/5	4-5
Hip Abduction	3/5	3+/5
Knee flexion	3+/5	4-/5
Ankle dorsiflexion	3-5	3-/5

PROM		
Ankle dorsiflexion	0-5°	0-5°

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## Functional Limitations

- MSWS-12 -Score of 46/100 indicates moderate impact, but does not exceed threshold of 75/100 which would indicate fall risk.
- The patient might be overestimating her walking ability.
- L.S. has “Quite A Bit” of difficulty with climbing stairs, balance when standing and walking, feeling slowed down when walking, and smoothness of walking, “Extremely” limited ability to run.

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## Functional Limitations

- DGI Score of 14/24 puts this patient well below the norm for healthy adults in her age group (23.9/24), and near the mean score of people with MS who had a history of falls (13.3/24), indicating an elevated risk for falling.
- L.S. has the most difficulty with **Gait Level Surface, Gait and Pivot Turn, Stepping Over Obstacle** and **Steps**
- L.S. has mild difficulty with **Change in Gait Speed** and **Gait with Horizontal and Vertical Head Turns**

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## Functional Limitations

- BBS-50/56- difficulty with tandem stance, single limb stance (Items 13 and 14)
- 6 Minute walk test- 1250 ' but 800 feet in the first 3 minutes, 450 in the last 3 , indicating limitations due to fatigability

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## Primary problems identified

- 1-(B) Plantiflexion contractures
- 2- Decreased BLE strength
- 3- Diminished Static and dynamic Balance
- 4- Diminished Gait Endurance

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## Problem 1-Interventions

- 1-(B) Plantiflexion contractures
- Intervention: Prolonged (B) plantiflexion stretch.
- Rationale- difficulty with gait may be due to toe catching
- Increase amount of time spent in stretching by use of nightsplint

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## Nightsplint



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## Interventions: Problem 2

- Problem: Decreased (B)LE strength
- Intervention: Intermittent strengthening of affected muscles
- High weight, low repetition, long recovery
- Rationale-intermittent exercise results in greater volume
- High weight with low reps has resulted in good outcomes for gait and balance, possibly due to greater CNS activation

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## Interventions: Problem 3

- Problem 3- diminished static and dynamic balance as evidenced by specific items on the BBS and DGI
- Interventions: Task specific practice
- Rationale: The DGI and BBS gives specific indications of which tasks are problematic. These are the tasks that therefore need to be part of the exercise program

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## Interventions

- | Static Balance       | Dynamic Balance           |
|----------------------|---------------------------|
| ▪ Tandem Stance      | ▪ Gait with head turns    |
| ▪ Single Limb Stance | ▪ Stepping over obstacles |
|                      | ▪ Ascend descend stairs   |

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## Example of treatment

### Tandem Stance

- How close to tandem can they achieve?
- Balance should be challenged, but not lead to fall
- Use visual cues to add stabilization
- Progressively move feet closer
- Add complexity by changing support surface, decreasing light, cognitive distraction
- Use light touch if needed
- Volume!

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## Example of treatment: Gait with head turns

- Test for vestibular involvement
- Practice head turns in standing (changing foot positions)
- Practice gait with head turns manipulating
  - speed of turns
  - range of turns
  - frequency of turns
  - speed of gait
- Find level at which it task is a challenge, but not impossible.
- Add challenge and complexity by manipulating the variables above

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## Interventions for moderate disability in MS

### Summary

- Larger accumulated deficit
- Interventions need to be at a higher volume
- Think long term- what will these patients be like in 20 years?

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## Characteristics of Severe MS disability

- Patient Non ambulatory or minimally ambulatory
- At risk for morbidity and mortality due to complications
- Severity can be due to multifocal involvement or profound focal involvement
- Accumulation of primary and secondary deficits

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## A shift in priorities/Severe MS

- The person with severe disability from a PT's perspective
  - Require moderate to maximal assistance with multiple aspects of functional mobility
  - Multifocal deficits
  - May be on multiple medications(DMT's, symptomatic control, comorbidity management)

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## A shift in priorities/Severe MS

- The person with severe disability from a PT's perspective
  - Unlikely to have substantial functional recovery
  - Some aspects of function that are not limited
  - Remediation much more difficult-management and prevention of further complications becomes a major goal

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## A shift in priorities/Severe MS

- Significant restrictions in flexibility, or risk of developing restrictions
- Primary and secondary weakness
- Primary and secondary respiratory issues
- Poor posture/postural control and associated problems
- Impact on communication, feeding, swallowing, bathing, dressing, toileting
- Unable to walk, or can walk only very short distances with assistance

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## The focus of PT interventions in severe MS

- Rehabilitative strategies for deficits not yet become severe to maintain maximum function
- Activities and equipment that maximize independence
  - Wheelchair seating and positioning
  - Adaptive equipment to assist with standing
  - Bed positioning devices

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## The focus of PT interventions in severe MS

- Maintain adequate flexibility even in the absence of strength
  - Function, pain control/prevention, skin safety
  - Consider the use of positioning aids in bed/chair
- Maximize/maintain respiratory function/hygiene
- Caregiver training
  - Bed mobility and transfer
  - Home exercise/stretching program
  - Quality of Life

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## The goals of PT intervention: Severe MS

- Caring for the person with severe MS requires a reframing of practice
- Shift in mindset to help the person with MS live with
  - the greatest amount of dignity and hope
  - maximizing quality of life by addressing person/family identified goals of the highest priority

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## Severe MS

- Role of PT: Prevent further deterioration due to disuse and prevent complications
- Improvements may be possible, especially if the disability is due to deconditioning rather than disease
- Not all cases are progressive-Twenty years after diagnosis, about two thirds of people with MS remain ambulatory without a wheelchair.

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## Severe MS disability- prognosis

### Favorable Prognosis

- Female sex
- Onset of symptoms before the age of 40 years
- Initial symptoms that are sensory only
- Involvement of only one CNS system at time of onset
- Full recovery between attacks
- Absence or late onset of cerebellar symptoms

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### Severe MS disability: Unfavorable prognosis

- Male sex
- Onset of symptoms after the age of 40
- Initial symptoms involving the cerebellum, mental function, or urinary control
- Initial symptoms that affect multiple regions of the body
- In the first years after onset, attacks that are frequent, or a short time between the first 2 attacks
- Incomplete remissions

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### Tests and Measures for Severe Disability

#### Tests and Measures for Severe Disability

- Respiratory measures- Max insp. and exp as measured by incentive spirometry
- Prolonged exhalation in seconds, words per breath
- Cough: strong, weak, (un) productive

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## Measures for Severe MS disability

- Bed mobility-rolling, supine  $\leftrightarrow$  sit
- Transfers-Bed  $\leftrightarrow$  Wheelchair/scooter/bath
- Sitting balance-can the patient sit w/o back support?
- When is a Mechanical lifter needed
- Wheelchair Mobility-manual vs electric
- Caregiver training- education, safety, advocacy

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## Measures for Severe MS disability

- Strength-with increasing immobility comes increasing weakness
- ROM-with increasing immobility comes increasing stiffness, especially in trunk and pelvis
- Sensation-with increasing immobility comes increasing sensory loss
- Motor Control-with increasing immobility comes increasing loss of movement skill and accuracy
- Skin integrity-with increasing immobility comes increasing risk of skin breakdown

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Case #3:  
PT Management of a Patient with  
Severe MS-Related Disability

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This case explores the following:

- How a physical therapist can provide palliative care to persons with severe MS disability to help them achieve their goals and prevent secondary complications related to MS.
- Address a patient's needs where the overall expectation is a further decline or deterioration in function
- Focus on PT goals to maximize function and quality of life while preventing secondary complications.
- This is a particularly challenging problem for the PT as there is very little evidence to drive decisions about care.

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## The situation at first contact

- Mr. D was 45 years old
- 16 year history of MS
  - RR (14 years) → SP
- Recent d/c from rehab to his home in a 4<sup>th</sup> floor, city apartment
  - Lateral transfers with a transfer board
  - Ambulated very short distances (5-10 feet) with bilateral assistive devices
  - Used a motorized scooter for home and community locomotion
  - He hired a part-time home attendant to assist with iADLs.

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## About a year passed...

- Physical function steadily deteriorated
- Required assistance bed mobility and transfers
- Marked decline in ambulation
- He called a physical therapist to come into his home to conduct an examination and help address his pertinent goals.

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## Examination/Evaluation

### Range of motion

- Mild to moderate limitations in wrist and finger flexion/extension; shoulder flexion/abduction/external rotation; mild limitation in ankle dorsiflexion

### Muscle strength

- MMT grossly 3/5 throughout bilateral hands/wrist and ankle; 4/5 at bilateral shoulder, elbow/ hip/ and knee

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## Examination/Evaluation

### Muscle Tone

- Modified Ashworth Scale = 1/5 in R ankle plantarflexors, knee flexors, and elbow flexors, 2/5 in L ankle plantarflexors, knee flexors, and elbow flexors and extensors, otherwise normal

### Respiration

- Weak cough. Incentive spirometer insp. and exp. to 750. Dyspnea on exertion, prolonged phonation 7.5 seconds.

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## Implications

- Diminished ability to use hand controls and to balance on scooter
- Diminished ability to perform stand pivot transfers
- Diminished ability to reposition in bed or sitting surface
- Diminished ability to clear secretions, increased risk of respiratory involvement, diminished oxygenation for ADL's
- Increased risk for skin breakdown

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## Questions for Interventions

- Can these be reversed?
- Can these be stabilized?
- What are the implications of no treatment?
- What interventions are possible?
- In the absence of evidence, PTs need to rely on their clinical reasoning skills

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## Problem/Intervention/Rationale

### Problem

- Decreased Bed mobility- Increases risk of bedsores, pulmonary compromise, diminishes quality of life

### Interventions

- Caregiver training, bed positioning devices, hospital bed with railing.
- Consider mechanical lift given likelihood of progression

### Rationale

- Maximize patient and caregiver safety
- Enable patient to get out of bed and interact with the environment.

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## Problem/Intervention/Rationale

### Problem

- ↓ transfers: Supine ↔ sit, Bed ↔ WC, (Stand-pivot, transfer board)

### Interventions

- Caregiver training. Use of assistive devices
- How much assist is needed?
- Manual vs mechanical lifts

### Rationale

- Maximize patient and caregiver safety
- Enable patient to get out of bed and interact with the environment.
- As disease worsens, patient will need progressively more assist

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## Problem/Intervention/Rationale

### Problem

- Unable to safely utilize motorized scooter for community access

### Interventions

- Procure stock manual wheelchair to be propelled by caregivers to facilitate community access
- Trial on a motorized WC- assess ability of patient to use hand controls

### Rationale

- Patient may not want to be (D) on caregiver
- Pt may not have manual skills for hand controls

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## Problem/Intervention/Rationale

### Problem

- Diminished respiration resulting in decreased ability to clear secretions, increased risk of respiratory compromise

### Interventions

- Prolonged phonation exercises, use of breathing training devices, positioning to stretch restricted thoracic muscles

### Rationale

- Combined effect of inactivity and weakness of respiratory muscles puts patient at risk for respiratory compromise

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## Problem/Intervention/Rationale

### **Problem**

- Diminished range and strength in BLE's and BUE's

### **Interventions**

- Caregiver training in PROM and PRE's.
- Bed positioning to prevent further deformity
- Nightsplints to maintain ankle ROM

### **Rationale**

- Progression of weakness as a result of inactivity as well as due to disease activity is still possible.
- Maintaining existing function may prevent or limit further disability.

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## Age related issues in MS

- Pediatric MS
- Older adults with MS

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## AGE RELATED ISSUES IN MS: **Pediatric MS**

- MS below 18 yo
- 2.7-10.5 % of all cases
- Overall female preponderance
- Children with onset before 6

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## Pediatric MS

- Female to male : 2.1-3/1
- Ratio increases to 1.6:1 for onset over 10 yo
- Higher proportion of African-Americans found
- Positive family history is seen in 6-20%
- May be dxed in adulthood, but symptoms may be noted as a child

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## Initial symptoms in children

- Optic neuritis (52%)
- Sensory disturbance (16%)
- Initial presentation rapid, resulting in admission to hospital within hours to a few days (71%)
- 50% risk for conversion from RRMS to SPMS was 23 years in children vs 10 years in adults
- Overall morbidity greater in children with MS when reach adulthood

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## Symptoms of pediatric MS

- Similar to that of adults
- Children more polysymptomatic
- Greater frequency of cognitive impairment
- Secondary deficits may be less rare
- Some symptoms may not become apparent until evidence of missed developmental milestones
- Symptoms may be misdiagnosed as developmental issues

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## Clinical features of Pediatric MS

- History of preceding infection
- More frequent & severe cognitive problems
- Seizures
- Children with MS develop repeated relapses and accumulate increasing disability
- Children have higher rate of relapse than adults in first 2 years
- Overall progression slower but more time to accumulate disability

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## Aging and MS

- 2 different issues
- 1-Early onset MS (EOMS )+ aging.
- 2-Late Onset MS (LOMS) [+aging] .
- Disability can be due to either
- 50% of individuals live over 30 yrs. after MS diagnosis
- 45% of people with MS are over 55 yo
- 65% of pwMS are still walking after 20 yrs.

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## LOMS vs EOMS

- Primary progressive course vs RR
- Motor sx more than sensory
- Spinal sx more prevalent than cortical
- Cerebellar sx less frequent
- Less responsive to steroids
- Associated with a faster progression

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## Aging and MS

- Consider an older adult with MS as potentially having the interaction of 2 conditions:

Multiple Sclerosis

And

Age related Changes

Similar to MS, many age related changes are secondary and due to disuse

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## Comorbidities associated with aging: Impact on MS

- Cardiovascular- decreased exercise tolerance
  - reduced cardiopulmonary reserve
- Neurologic- decreased neuroplasticity
  - diminished NCV
- Respiratory- reduced volume and efficiency
  - postural changes lead to decreased space for gas exchange
- Integumentary- reduced thermoregulation and thermal sensitivity
  - increased risk for skin breakdown

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## Comorbidities associated with aging: Impact on MS

- Musculoskeletal- decreased soft tissue extensibility
  - decreased force production,
  - increased co-activation of antagonist
- Vision- diminished acuity
  - decreased ability to use visual cues for gait and balance
- Vestibular- loss of hair cells in semicircular canals leads to diminished postural control
- Sensory-diminished distal peripheral nerve function leads to decreased ability to use sensory cues from the feet

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## Gait and Balance in older adults

### Gait

- Diminished push off
- Wider stance
- Diminished Hip extension
- Crouched gait
- Diminished trunk rotation and armswing
- Primary or secondary?
- Learned or due to disease?

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## Gait and Balance in older adults

### Balance

- Increased falls risk in Older adults
- Co-activation response to perturbations
- Diminished strength and flexibility diminish range and power of postural responses
- Voluntary movement restriction (“The less I move, the less chance of falling”)

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## Treatment Strategies for older adults with MS

- EOMS or LOMS?
- Mid, mod or max disability
- What is primary and What is secondary?
- Fatigue will probably be more prominent
- Use cooling modalities with caution due to reduced thermal sensitivity
- Assume that much of the movement restriction is learned
- What are the patients goals

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## Summary

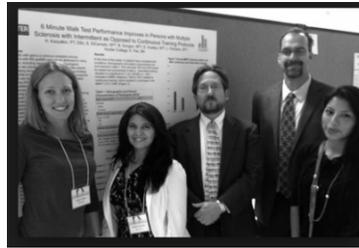
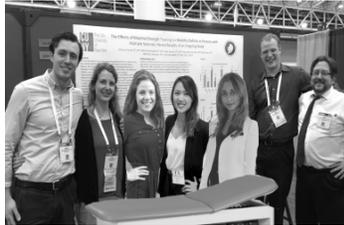
- Multiple Sclerosis is a disease of variability
- Regardless of degree of disability or age, fatigue will be prominent
- Assume much of the disability is secondary and therefore remediable
- Herbkarppt@gmail.com

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## Thank you from Hunter College Physical Therapy MS Research Team!



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