

# Case Study: Secondary Progressive MS

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# Case Learning Objectives

- Identify need to examine respiratory muscle strength
- Identify need for respiratory muscle strength intervention
- Identify appropriate measurement tool for respiratory muscle assessment
- Identify appropriate respiratory muscle strength training protocol

# Sue: Demographics

- 51 y.o. female
- Secondary progressive MS
- Onset 27 years prior
- EDSS = 2.5

# Sue: Co-morbidities & Symptoms

## Co-Morbidities

- Allergies
- Hepatitis A
- Arthritis
- Mild depression

## Symptoms

- Fatigue
- Visual disturbance
- In-coordination
- Numbness/tingling
- Muscle weakness
- Dysphagia with gastric feeding tube

# Sue: Medications & Activity Level

## Medication

- Copaxone
- Baclofen
- Klonopin
- Neurontin
- Estrace

## Activity Level

- Iyengar yoga 90 minutes twice/week
- Mild Hatha yoga 60 minutes once/week
- Out in community on a daily basis
- Works part-time

# Sue: Need for Respiratory Muscle Examination

- Most people with MS do not complain about decreased respiratory function (Altintas, 2007)
- Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP), indirect measures of pulmonary muscle strength, are both significantly reduced in patients with MS.

# Sue: Need for Respiratory Muscle Examination

- In ambulatory patients with MS:
  - Average MIP values range from 55-77% of predicted values
  - Average MEP values range from 34-60% of predicted values
- In patients with MS who are primary wheelchair users or who are confined to the bed:
  - Average MIP values range from 27-74% of predicted values
  - Average MEP values range from 18-51% of predicted values

# Sue: Manometry Assessment Device

- Manometer to test:
  - Maximal Inspiratory Pressure (MIP)
  - Maximal Expiratory Pressure (MEP)



# Sue: Spirometry Assessment

- Spirometer to test (values obtainable dependent on device used):
  - Forced Vital Capacity (FVC)
  - Forced Expiratory Volume in 1 second (FEV1)
  - Peak Expiratory Flow (PEF)
  - Maximal Voluntary Ventilation (MVV)
- Values compared to normative data referencing gender, age, and height

# Sue: Training Protocol

## Protocol

- 10 weeks of daily exercise with a pressure threshold load trainer
- 3 sets of 15 repetitions
- Initial pressure set at 30% of MIP
- Weekly phone call to guide progression
- Progressed based on symptoms, RPE, and initial MIP

## Respironic Inspiratory Muscle Trainer (IMT)



# Adjustment of Training Threshold Load By Use of RPE

**TABLE 1.** Ten-Week Home IMT Exercise Training Protocol

Frequency: IMT exercises performed daily for 10 weeks.

Overload: Repetitions and Sets: Three sets of 15 repetitions\*

Resistance: Initial resistance (H<sub>2</sub>O cm) of the IMT was set at 30% of the subjects pretest MIP.

Progression: Subjects were called once per week by one of the investigators to assist with IMT pressure resistance training progression. IMT pressure resistance was progressed weekly according to the subject's baseline MIP pressure and RPE as well as the subject's symptoms

## Subject's Baseline MIP Pressure: <50 cm H<sub>2</sub>O

Borg RPE	<13	13 to 15	>15	>17
Pressure resistance (cm H <sub>2</sub> O)	Increased by 2	Increased by 1	Maintained at same level	Reduced by 2

## Subject's Baseline MIP pressure: >50 cm H<sub>2</sub>O

Borg RPE	<13	13 to 15	>15	>17
Pressure resistance (cm H <sub>2</sub> O)	Increased by 4	Increased by 2	Maintained at same level	Reduced by 2

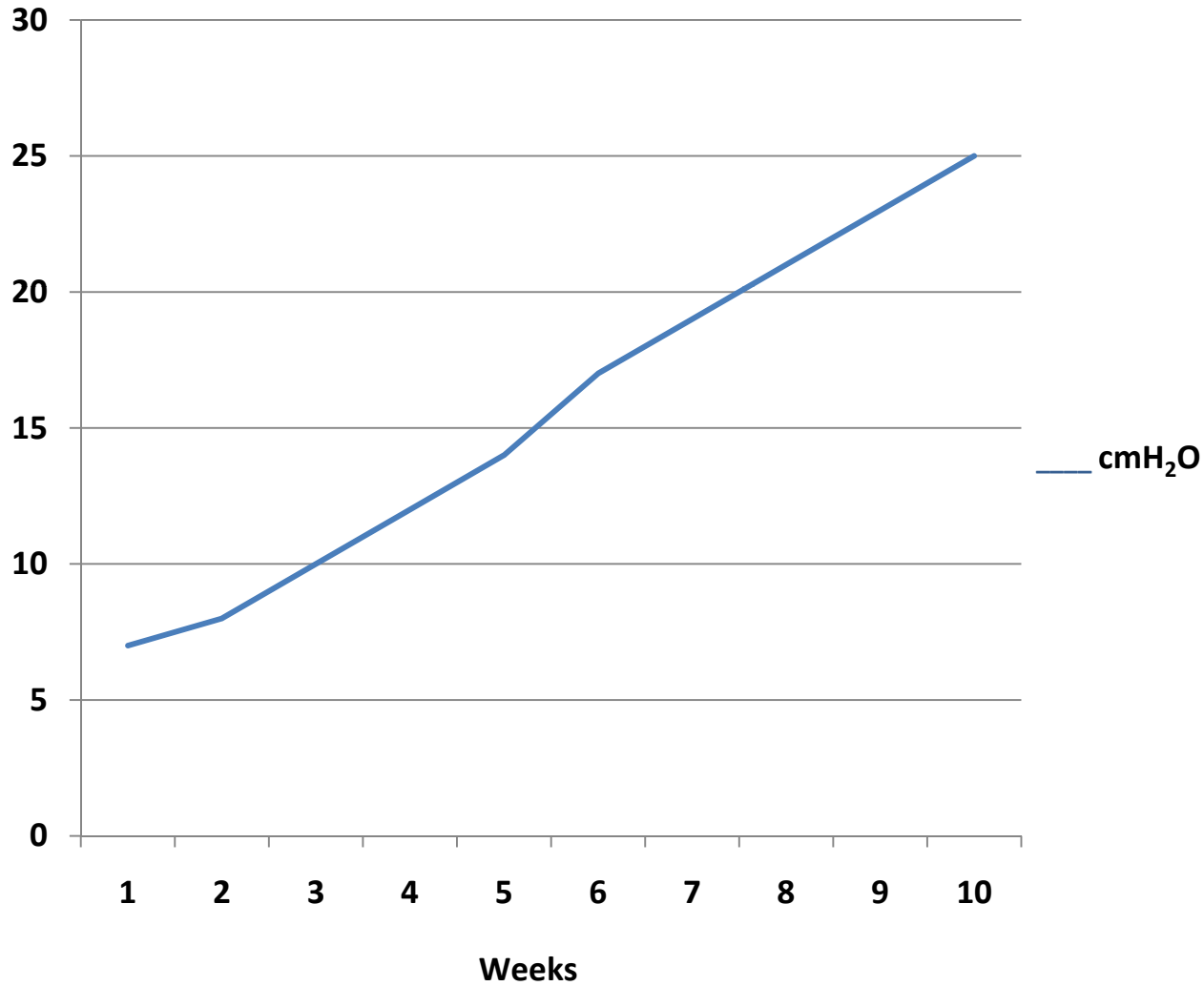
If subjects developed symptoms (ie, dizziness, lightheadedness, or shortness of breath) while performing IMT exercises, the resistance was adjusted as follows until no symptoms persisted.

Symptoms	Two or more symptomatic episodes in a row per week	1–2 isolated symptomatic episodes per week
Pressure resistance (cm H <sub>2</sub> O)	Decreased by 2 subjects were called back 3 days later to monitor subject's response	Held constant, subjects were called back 3 days later to monitor subject's response

\* If a subject achieved the maximum IMT Trainer pressure resistance of 41 cm H<sub>2</sub>O and resistance could no longer be increased, a fourth set of exercises was added along with an increased number of repetitions up to a maximum of 15 repetitions.

Abbreviations: IMT, inspiratory muscle strength training; MIP, maximal inspiratory pressure; RPE, rating of perceived exertion.

# Sue: IMT Exercise Progression

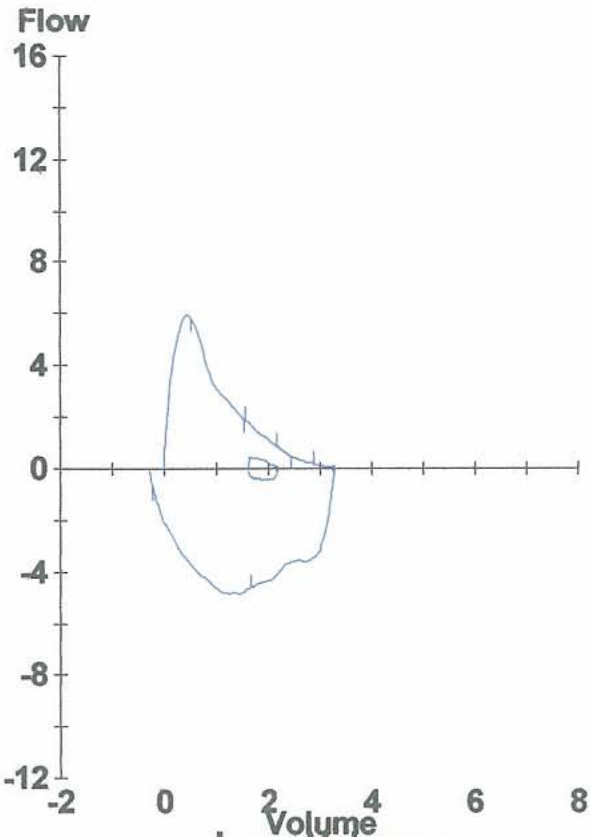


# Sue: Demographics

- 51 y.o. female
- Secondary progressive MS
- Onset 27 years prior
- EDSS = 2.5

# Sue: Spirometry

Gender: Female Age: 51  
 Diagnosis: Secondary Progressive



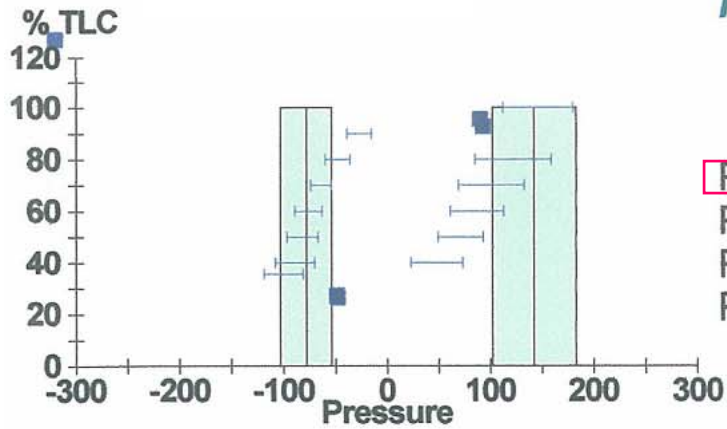
## Spirometry

		Ref	Pre Meas	Pre % Ref	Post Meas	Post % Ref	Post % Chg
FVC	Liters	3.28	3.29	100	3.78	115	15
FEV1	Liters	2.49	2.20	88	2.41	97	9
FEV1/FVC	%	75	67		64		
FEF25-75%	L/sec	2.86	1.27	44	1.26	44	-1
PEF	L/sec	5.95	5.93	100	6.57	110	11
FET100%	Sec		9.30		11.48		23
FIVC	Liters	3.28	3.55	108	3.45	105	-3
FIF50%	L/sec		4.60		5.54		20
FVL ECode			000000		000000		
MVV	L/min	99	89	90	111	112	25
	MVV 6 L/min		85		109		28
	f BPM		65		110		69

# Sue: Discussion of Spirometry Results

- Sue was in relatively normal range for spirometry measures.
- Improved function in primary values of interest:
  - FVC
  - FEV1
  - PEF
  - MVV

# Sue: Manometry



## Maximal Respiratory Pressures

		Ref	Pre Meas	Pre % Ref	Post Meas	Post % Ref	Post % Chg
PI max	cmH2O	78	49	63	83	106	69
PI Volume	Liters		0.95		1.14		20
PE max	cmH2O	143	93	65	107	75	15
PE Volume	Liters		2.05		2.27		11

# Sue: Discussion of Manometry Results

- Baseline values at 63% for MIP and 65% for MEP.
  - Any value under 60% of predicted for MIP and MEP is considered clinically abnormal.
- Increase of 69% in MIP and 15% in MEP following IMT strengthening.

# Sue: Discussion of Spirometry and Manometry Results

- Respiratory muscle weakness must be approximately less than 50% of normal to see reduction in spirometry values. (Rochester, 1994)
- Sue displayed significant respiratory muscle weakness even with relatively normal spirometry values.
- Thus, manometry is a more sensitive measure of respiratory muscle dysfunction in persons with MS.

# Sue: Functional Outcomes

Activity	Pre-test	Post-test
Single Limb Stance	4.38 seconds	14.53 seconds
Functional Stair Test	3.78 seconds	3.13 seconds
Sit-to-Stand Test	10.75 seconds	9.60 seconds
Six Minute Walk Test	1712 feet	1807 feet
Fatigue Severity Scale (7 point likert scale)	Mean score = 6	Mean score = 3.3

# Sue: Anecdotal Follow-up

- Sue continued to use the IMT for one year following the study because she felt it was helpful.
- Continues with Iyengar yoga with strong emphasis on breathing

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