

# Physical Therapy and the Treatment of Pain

Christine Zampach PT, MEd, DPT  
University of New Mexico PCTC and Project ECHO  
University of California San Francisco  
School of Medicine  
Associate Clinical Professor

I have nothing to disclose.

# Project ECHO®

*... promotes care in underserved areas*

The mission of Project ECHO® (Extension for Community Healthcare Outcomes) has been to develop the capacity to safely and effectively treat chronic, common, and complex diseases in rural and underserved areas, and to monitor outcomes of this treatment.

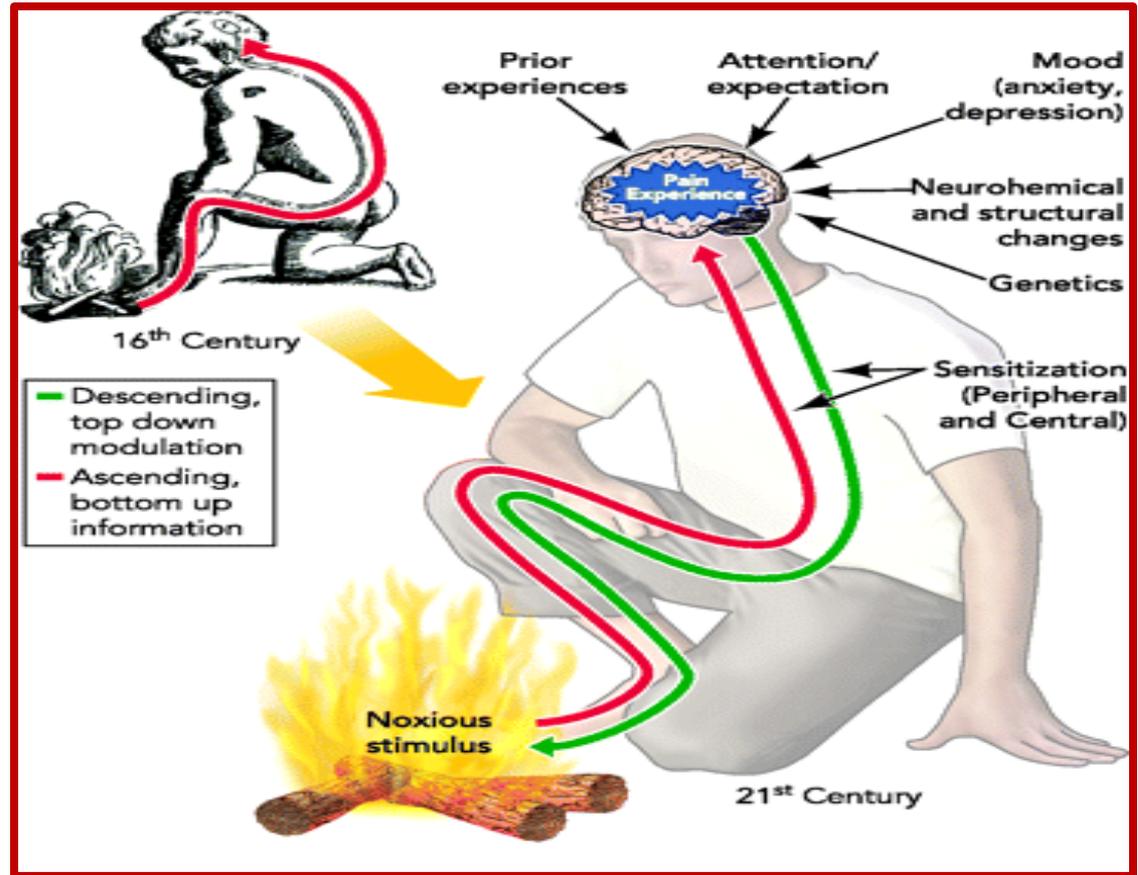
Project ECHO is funded in part by a grant from the Robert Wood Johnson Foundation and has received support from the New Mexico Legislature, the University of New Mexico, the New Mexico Department of Public Health and Agency for Healthcare Research and Quality.

# Objectives

- Participants will be:
  - Introduced to how physical therapists are looking at pain.
  - Shown how common pain diagnoses have similar nervous system changes.
  - Seeing how the following diagnoses are being treated in physical therapy
    - Complex regional pain syndrome (CRPS)
    - Phantom limb pain
    - Fibromyalgia syndrome (FMS)
    - Failed Back Syndrome and Low Back Pain(FBS &LBP)

# Pain in the 21<sup>st</sup> Century

- Descartes 1664



# International Association for Study of Pain (IASP)

- Pain is “an unpleasant *sensory* & *emotional* experience associated with actual or potential tissue damage, described in terms of such damage.”

# Chronic Pain = Pain Centralization = Neuroplasticity

- The “rules” change as pain starts to alter structures of the brain
- The brain does not have just one single pain center
- Changes occur from the spinal cord to the brain

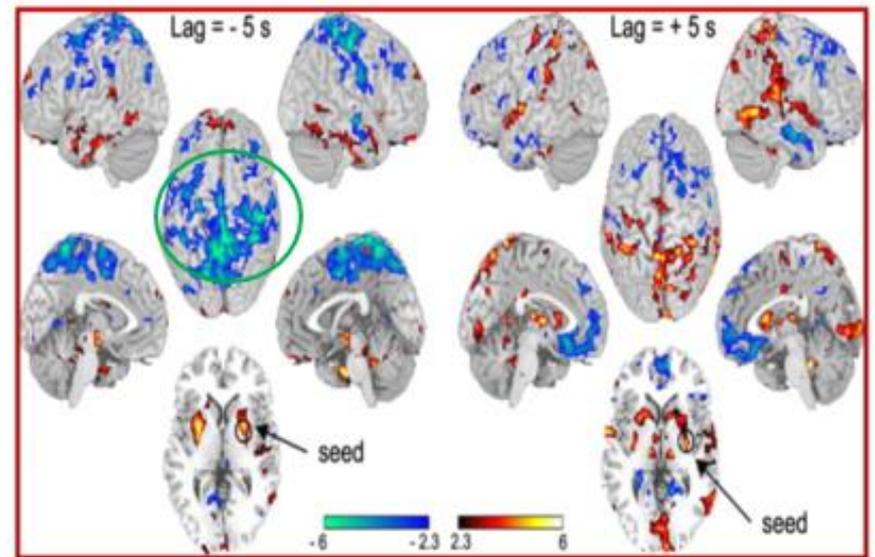
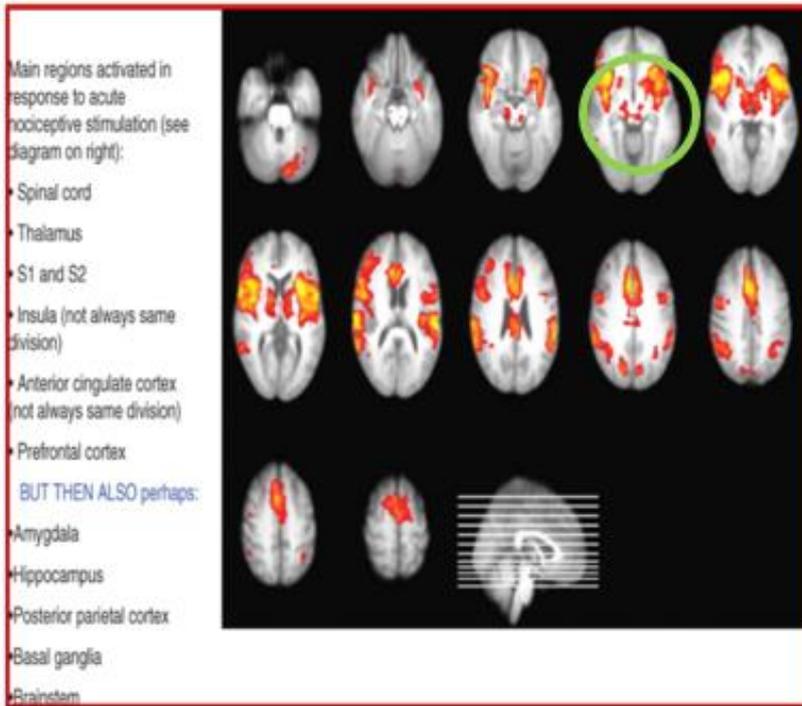
# Central Nervous System Changes – Neuroplasticity

- Nerve sprouting
- General dis-inhibition
- Brain map remodeling - **PT intervention**
- Loss of neurons and neuronal function
- De-innervation
- Alterations in neuronal and glial activity
- Sensory-motor and sensory-sensory incongruence - **PT intervention**

# Cortical Remapping – Neuroplastic Changes

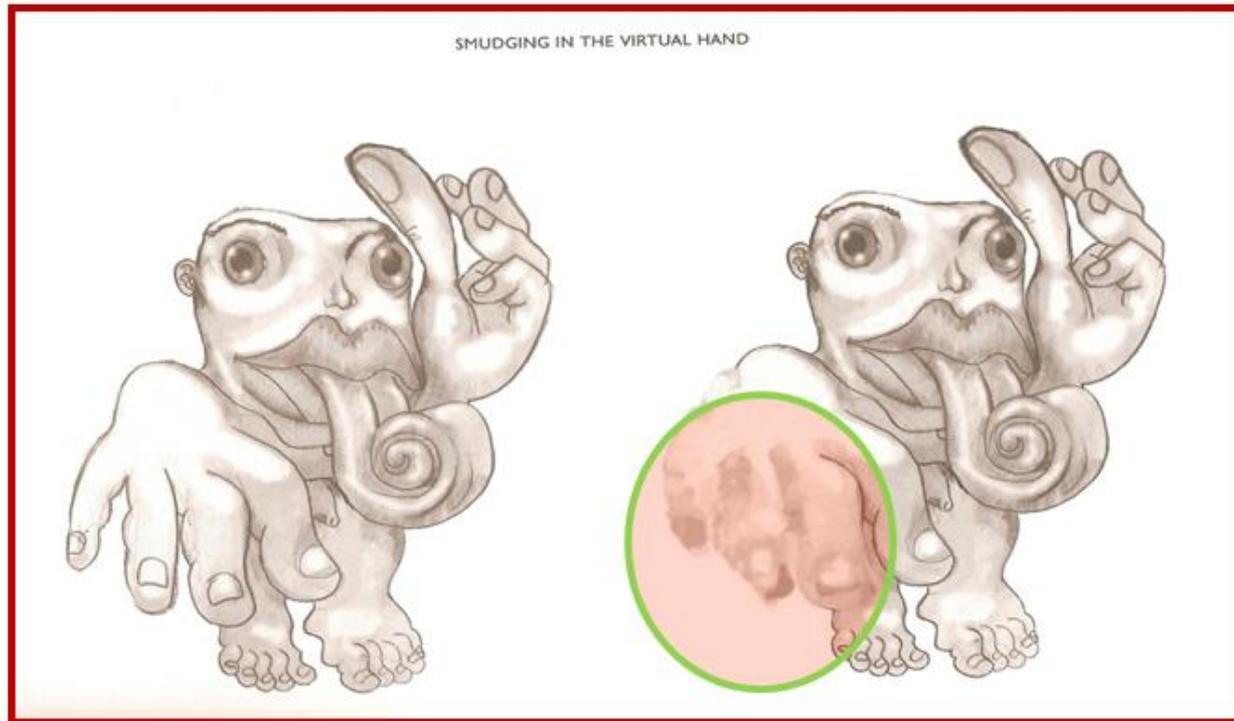
- Visual attention and the motor system remaps the cortical model of pain.
- The external and internal stimuli usually are interpreted and managed “correctly”.
- Except when conflicts arise.
  - Continued pain
  - Emotional stressors
  - Amputation: decreased sensory & motor normal input

# Nociceptive vs. Allodynia



# Primary Somatosensory Homunculus In Pain

- Smudging of pain area representation in the brain



Butler DS, Moseley GL. *Explain Pain* 2003.

# Neuroplasticity = Learning

- The CNS changes to meet the needs of body
  - Information comes in from all our senses
  - Information is interpreted, categorized and stored
  - Learning strategies are very individual
    - Verbal
    - Visual
    - Tactile
    - Proprioception

# Neuroplasticity and Pain

- The question is can we learn to:
  - Change pain memories?
  - Interpret pain differently?
  - Modify the interplay of the areas in the CNS that influence pain?
- Can we use what we know about neuroplasticity in the treatment of pain?
  - Decrease pain input
    - Pacing not pushing patients into pain
  - Increase “proper” sensory input
    - Use all sensory organs
  - Motor input must be as close to “normal” as possible
    - Modify activities to be as close to “normal” motor patterns
  - Stop the “pain brain bounce” to help calm the CNS
    - Cognitive Behavior Therapy
    - Relaxation
    - Visualization

Ji RR, et al 2003. Lewandowski W 2005. Moseley, G.L. 2004.  
Knost B, et al. 1999. Lotze M, et al 1999. Foster NE, 2011.  
Iwabe T, 2014.

# Neuroplasticity and Treatment Strategies

- If neuroplasticity is learning, can we teach the CNS to have less pain?
  - Learning experiences must be:
    - Each part building on each other until there is a WHOLE pain free motor pattern. (Whole-part-part-part...whole)
    - Paced: do not push patient into pain
    - Practiced over an extended period of time: short practice sessions but more often
    - Don't trigger: Kinesiophobia, fear-avoidance, catastrophizing
    - Patient needs understanding of what is happening in the CNS

# Education and Treatment Strategies

- Cannot separate the mind-body-spirit
  - ↑ stress will ↑ pain
- Yes, pain is in your head (your computer).
  - Our computer hard drive is pre-programmed to act on acute pain signals, but does not understand chronic pain.
    - Interpret pain - sensory
    - Motor patterns
- We can re-write the hard drive with proper sensory and motor input.

# Education to Change a Patients Ideas About Pain and Therefore Change Their Pain

- Neuroscience Education
  - Explain the neurobiology and physiological of the nervous system's reaction to injury and pain.
  - What the patient can do to change their interpretation of pain and therefore their pain
  - Decrease the emotional aspect of pain
    - Kinesiophobia
    - Fear Avoidance
    - Catastrophizing
  - Have the patient understand the importance of moving

# What is Complex Regional Pain Syndrome?

# CRPS is:

- A neuroinflammatory condition
- A complex neuropathy
- The CRPS cascade
  - Nociceptive incident?? → inflammation → neuropathic changes (ectopic, phenotypic) → central sensitization → neuroplastic brain changes
- The diagnosis criteria 1994: The International Association for the Study of Pain (IASP)
- The Budapest Criteria
- Reflex Sympathetic Dystrophy (RSD) a old term and should not be used

# CRPS



# Why Physical Therapy Treatment?

- There is no gold standard for medical treatment.
  - Medication: oral or infused
  - Blocks: Sympathetic, nerve root, epidural
  - Spinal cord stimulator???
- Physical therapy should be a part of treatment.
  - Working with neuroplasticity
  - Graded Motor Imagery
  - Mirror only
  - Graded exposure??

Perez, RS, 2010. Daly, A. 2008. Ek, J-W 2009.  
Bowering, KJ, 2013. Sato, K. 2010.

# Dysfunctions Affecting Physical Therapy Treatment Strategies

- Takes longer to recognize affected hand\*,+
- The whole scheme of the body is affected:
  - Body recognition is poor
  - Mental representation of movement is affected\*\*
- The somatosensory homunculus changes
  - Continuous pain enlarges the representation of the painful area i.e. it takes less stimuli to trigger pain++
- Changes in the somatosensory of the whole affected limb not just the foot or hand

++Butler SB 2000. +Juottonen K, et al 2002.\*\*\*Maihofner, C. 2004 & 2007.  
\*\*Schwoeble J. 2002 & 2001. \*Moseley GL 2004.

# Strategies For Physical Therapy Treatment

- Sensory input
  - Desensitization
  - Visualizing motion and touch
  - Proprioception with weight bearing activities
- Motor
  - Motion without pain
  - Imagination of movement: Pre-motor
- Mind-Body connection
  - Educate, educate, educate
  - Progressive muscle relaxation
  - Guided imagery

# Strategies For Treating CRPS

- New clinical treatment models – Graded Motor Imagery
  - Mirrors
  - Imaginary movement
  - Imaginary touch
- Standard physical therapy
  - Desensitization
  - ROM & function
- Intensive *painful* physical therapy is contraindicated.
  - Central hyper-excitability increases pain and bad neuroplastic changes.

Schaefer M, et al. 2006 and 2007. Lidbeck J, 2002. MacLachlan M, et al. 2004. Brodie EE, et al. 2003. Ramachandran VS & Rogers-Ramachandran D. 2000. Moseley G.L. 2004

*“Graded motor imagery (GMI) is effective for long-standing Complex Regional Pain Syndrome: a randomized controlled trial.”*

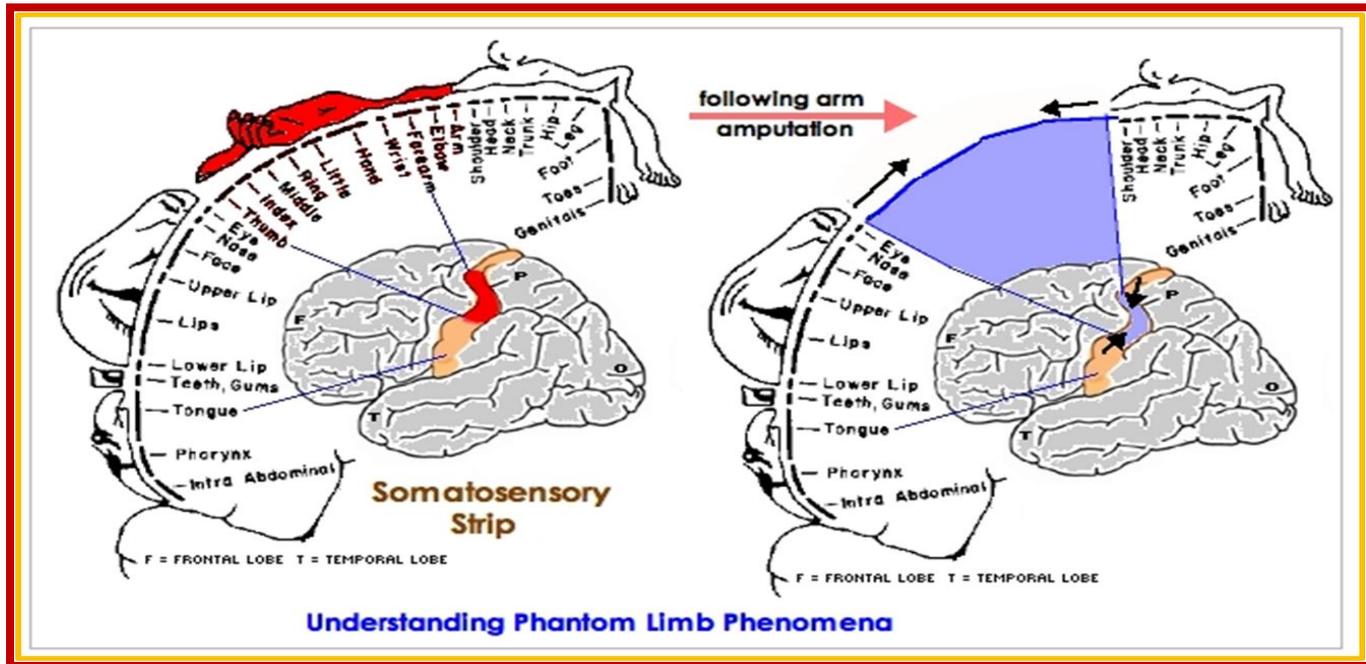
- Experimental Group (2 weeks of each & crossover of control group)
  - Recognition of hand laterality – 42 pictures, timed response
  - Imagined hand movement – 28 pictures
  - Mirror therapy – mirror box - 20 pictures

# Phantom Limb Pain – Very Similar to CRPS

- Loss of a limb affects the somatosensory and motor cortexes
  - Disruption of Motor intension
  - Absence of “normal” sensory
  - Proprioception is absent
- Cortical reorganization
- Very similar to Complex Regional Pain Syndrome and the treatment is similar

# Amputation=Neuroplastic Changes

- Incorrect input overwhelms the sensory interpretation of the area in the CNS.



# Phantom Limb Pain

- More pain prior to amputation more pain after
- Ways to keep pain from changing CNS
  - Epidurals and nerve blocks done in the field or at medical station in Afghanistan
  - Gabapentin pre-op for mastectomies
  - Keep the sensory & motor block for 24 to 48 hours after a surgery
- The psychological stresses recognized and treated ASAP
  - PTSD

# How Physical Therapists Treat

- Education
- Graded Motor Imagery (think CRPS)
- TENS
- Desensitization

# **Does Fibromyalgia Fit the Clinical Model of Central Sensitization and Neuroplasticity?**

# What is FMS?

- Wide Spread allodynia?
- Fibromyalgia is a disorder of afferent processing?
- Symptoms are multifocal – clinical DX
- What science is saying (2011 to 2012)
  - Mitochondrial dysfunction
  - High serum inosine levels with low adenosine levels
  - Increased Interleukin-8 levels in CSF
  - Autoimmune activity against 5-HT
  - Elevated neuroendocrine-stress markers( cortisol, NA, IGF-1)

Cordero, M.D., 2012. Fais, A., 2012. Maes, M, 2011.  
Kadetoff, D, 2011. Smith HS, 2011.

# Central Sensitization

- Dysfunction of the descending pain modulation.
- The processing of sensory signals becomes affected.
  - Decreased threshold for pain.
  - Amplification of pain.
- Nociceptive Processing.
  - Decrease in serotonin:
    - Decreased blood Tryptophan
    - Decreased CSF Tryptophan
  - Increased Substance P in CSF

# Neuroplasticity

- The central sensitization changes the somatosensory cortex.
- Cortical reorganization: as this increases there is increased pain.
  - Decreased gray matter in pain modulation areas
- The FMS motor cortex does not appear to be significantly changed as it is in CRPS.
  - Except decreased ability to relax muscles after a contraction?

Puretic, M.B 2013. Moseley, G.L. & Flor, H. 2012. Fallon, N. 2012.  
Ceko, M, 2011. Smith HS, 2011. Van Houdenhove B. 2005.

# Physical Therapy Treatment Strategies

- Calm the CNS and return to movement without increasing pain.
  - Sleep hygiene (80% with dysfunction)
  - Breathing (rapid upper chest breathing -hyperventilation)
  - Eating habits (50% have hypoglycemia tendencies)
  - Pacing and relaxation
  - Exercise
    - Pool
    - Isometric
    - Aerobic - walking
    - Home

Nijs j, 2010. Mannerkorpi K, 2009. Busch AJ 2008.  
Robinson ME , 2005. Staud R, 2005.

# Breathing Treatments

- Teach patient
  - How to use a foam roller (6"X 36") or rolled blanket for chest stretch and posture correction.
  - Four count diaphragmatic breathing
  - Relaxation and guided imagery
- Physical therapist mobilizes
  - Ribs
  - T-Spine



# Exercise: Progress Very Slowly

- Aerobic
  - Walking with a friend
  - Warm water pool
- Stretching
- Light weights or theraband
- Community based programs
  - Yoga
  - Feldenkrais®
  - Tai Chi, Qigong

Wang C, 2010. Carbonell-Baeza, A. 2013. Nugraha, B. 2012. Longhorst, J., 2012. Thompson, J.M. 2012. Silva, K.M., 2012. Hooten, W.M. 2012. Wilson, B., B, 2012. Sanudo, B., 2012. Romero-Zurita, A. 2012.

# FMS Diary

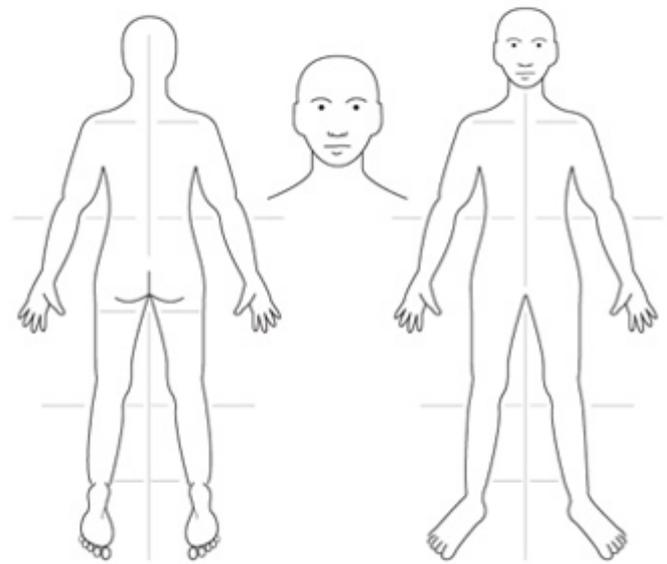
Name \_\_\_\_\_ Date \_\_\_\_\_  
Sleep: \_\_\_\_ PM \_\_\_\_ AM \_\_\_\_ Total Time. Naps: \_\_\_\_ Total time \_\_\_\_

Pain level: 0 \_\_\_\_\_ 10  
Energy level: 0 \_\_\_\_\_ 10  
Mood in general:

What made you happy today?:

Exercise: \_\_Stretching. \_\_Strength.  
Aerobic: \_\_\_\_\_  
Community: \_\_\_\_\_

Eating:  
Breakfast                      Lunch                      Dinner                      Snacks



## Failed Back Syndrome – FBS

(Also other chronic back pains can be included)

# What is FBS?

- A patient who has 1 or more spinal surgeries in which the outcome does not meet the expectations of the patient.
  - Decrease in pain
    - Low back
    - Legs
  - Increase in function
- ICD-9 Codes are Failed Laminectomy by spinal region.

# What are the Pain Generators?

- On going nociception
  - Facets OA
  - Other discs proximal or distal of the surgery
- Inflammation of the tissues
- Neuropathic
  - Continued stenosis
  - Pre surgery and surgical nerve damage
- All of the above

# Treatment Guide Remember Centralization and Neuroplasticity

- Teach movement without pain (Feldenkrais®)
- Self care management of pain
  - Ice or heat
  - Pacing
  - Short rests
- Movement Impairment exercises: muscle balance
  - Too weak or too strong
  - Too long or too short
- Stabilization: The 3 B's (belly, back, buns)
- Aerobic
  - Walking
  - Swimming
  - Stationary biking
- Myofascial dysfunction (passive so will be done later in the treatment)
  - Myofascial release
  - Trigger point release
    - Manual
    - Dry needling

Sahrman S. Diagnosis and Treatment of Movement Impairment Syndromes, 2002.

# Exercise Progression

- Progress the program not expand it.
  - Never more than 5 exercises.
- Strengthen, stabilize and ROM first.
- Hands on only after patient is doing “active” PT
- Address the neurodynamics a little later after you get to “know” the patient’s nervous system.
- Pacing not pushing
  - Use pain flares as teachable moments.

# My First Treatment for FBS and most other Chronic Pain Syndromes

- 1 hr initial evaluation 30 minute treatment
  - 30 minutes of Hx and examination
  - 30 minutes of treatment
- Set goals with patient
  - Measurable
  - Time frames
- Set plan with time frame (1x/week 6 weeks)
- Start education about pain
- Set treatment ground rules
  - No passive treatments – maybe later
  - They do the exercises/work and I coach them
  - If they do not do their job of exercises/activities taught, I cannot help them.

# Summary

- All chronic pain diagnoses have similar characteristics
  - Centralization of pain
  - CNS changes
  - Neuroplastic changes
  - Emotional involvement
- Physical therapists have the skills to treat pain patients and we need be part of the team

Thank You!  
Any questions?