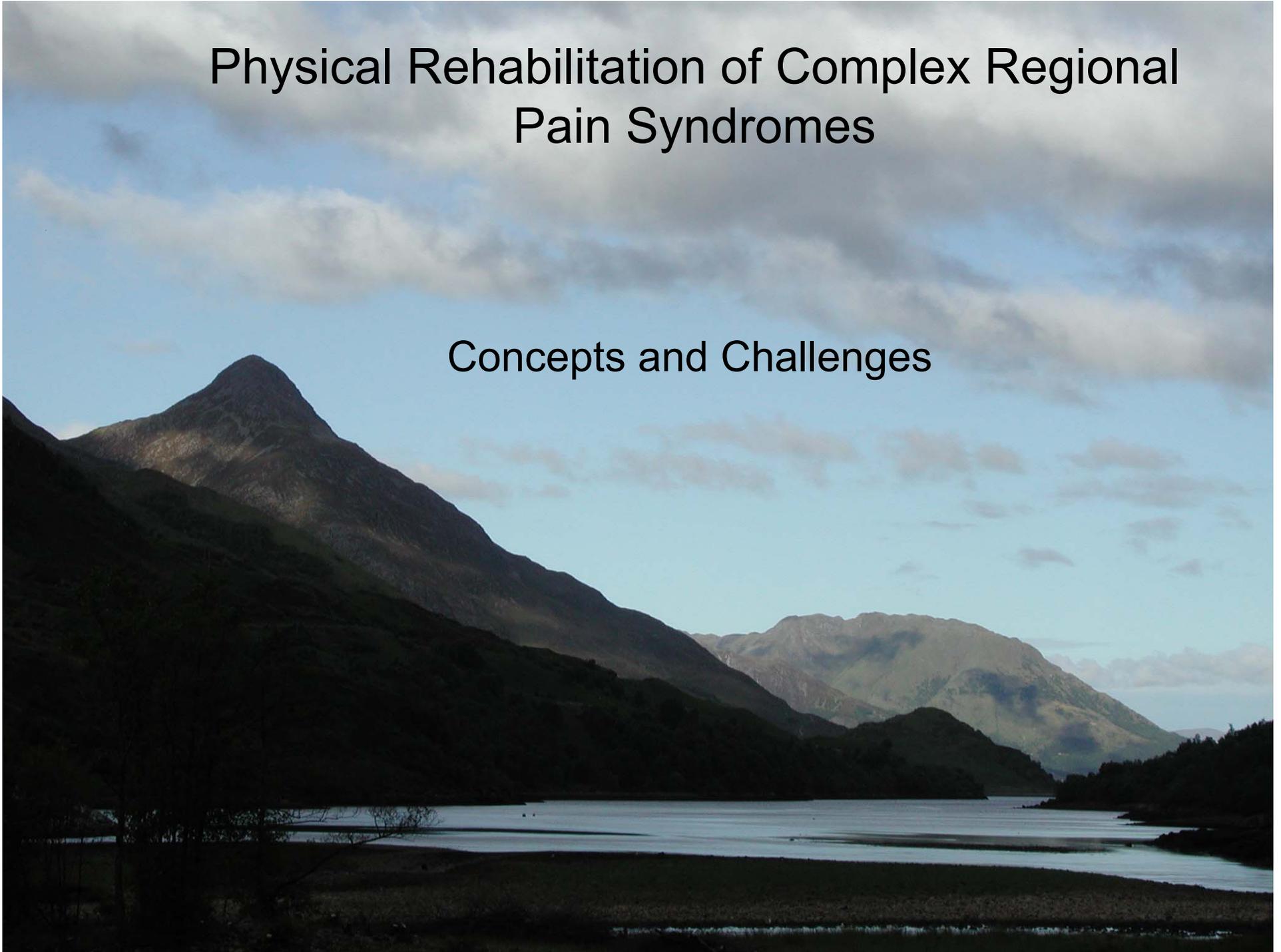


Physical Rehabilitation of Complex Regional Pain Syndromes

Concepts and Challenges



Physical Rehabilitation goal for CRPS

Reduce fear of movement and increase function through educating patients to better understand a chronic pain model accompanied by active treatment that emphasizes the development of transferable skills for pain management and includes home exercises and functional activities to promote neurologic and orthopedic health.

Pain Neuroscience Education

A sound understanding of the healthy nervous system vs. the CRPS affected nervous system is the foundation of any treatment.

Pain Neuroscience Education

Goals:

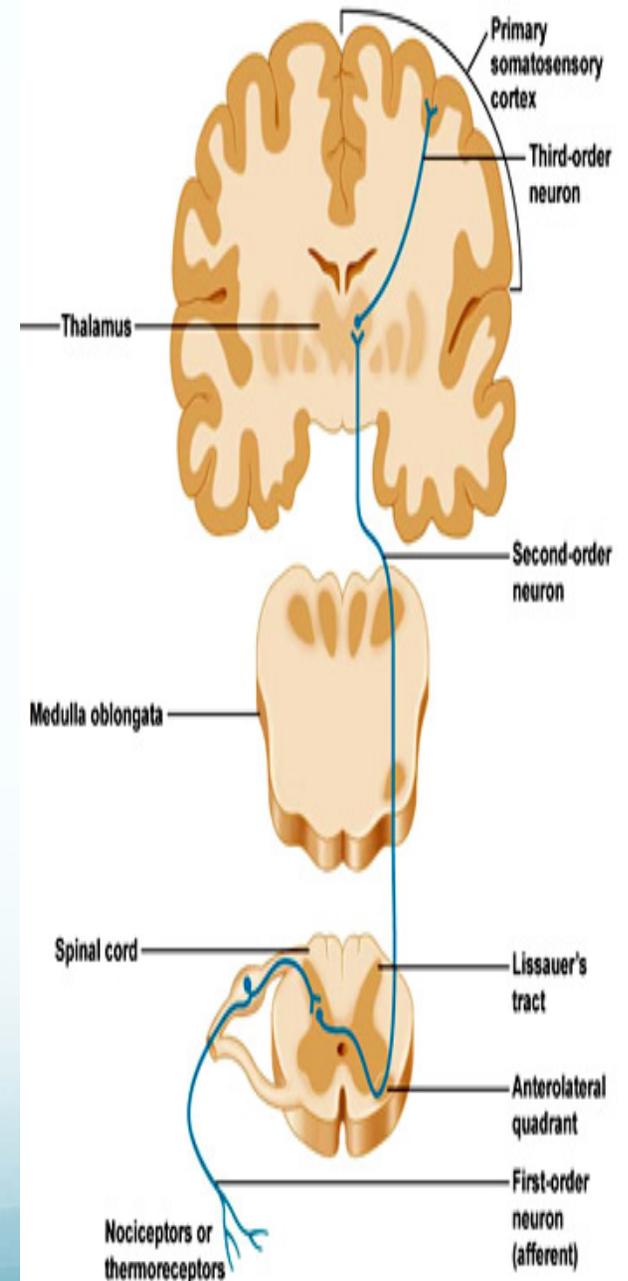
- Reduce fear of movement and increase function through educating patients to better understand a chronic pain model.
- Eliminate the perception of pain as a sensation and replace this with recognition of pain as an experience
- Understand that Pain \neq Tissue Damage
- Recognize movement as essential for health of the body and mind
- Create the conditions under which healing becomes possible

Key Concepts of Pain Neuroscience Education

- Nociception: the process by which information regarding harmful or **potentially** harmful stimuli is transmitted to the central nervous system
- Three types of nociceptors
 - Mechanical
 - Thermal
 - Chemical

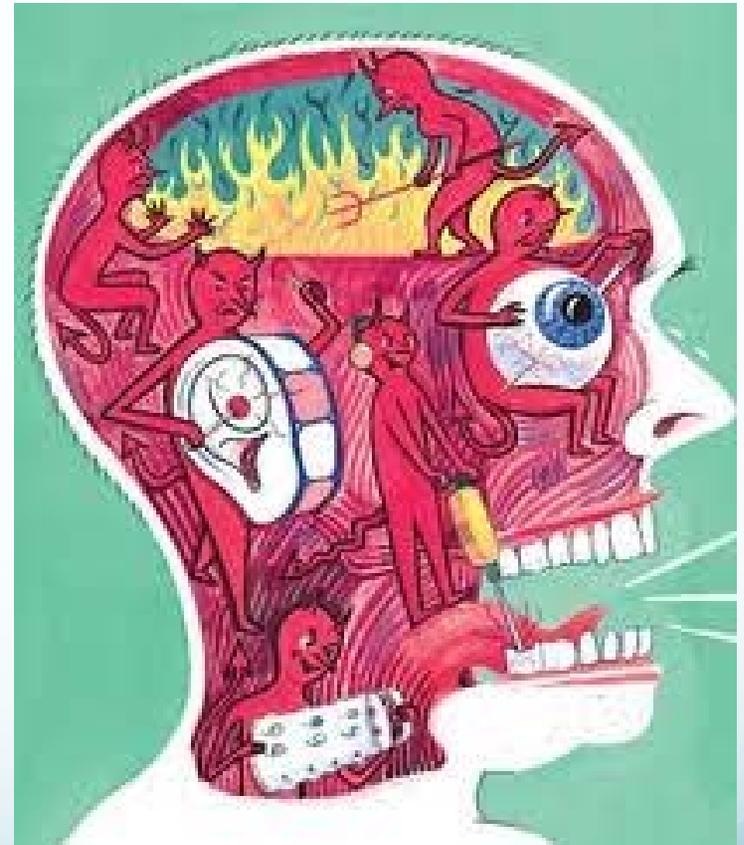
The Nociceptive Process

- Transduction: Convert energy from noxious stimulus to electrical energy
- Transmission: Neural signals from the periphery to the spinal cord and the brain
- Perception: Appreciation of signals arriving in higher structures as pain
- Modulation: Inhibition or facilitation



Perception and Modulation

- Perception and Modulation are the brain processing the nociceptive input. This is influenced by previous experience, expectations about consequences, beliefs, knowledge and cultural, social and environmental factors
- We all have the ability to turn the volume up or turn the volume down on our pain. Pain is derived from the brain and is determined by the perceived level of threat to our body



Acute vs. Chronic Pain

Adaptive vs Maladaptive Pain

Acute Pain: IASP nociceptive pain is coupled to the presence, intensity, or duration of noxious peripheral stimuli. This type of pain is crucial for survival.

Chronic Pain: IASP “pain without apparent biological value that has persisted beyond the normal tissue healing time usually taken to be 3 months”. Not always coupled to nociception

- ◆ Be it acute or chronic: pain is not synonymous with tissue damage
- ◆ We can have nociception without pain. Likewise we can experience pain without nociception.
- ◆ Distraction, meditation, **movement**, laughter, **diaphragmatic breathing** are tools that can be used daily to inhibit pain.
- ◆ **Fear, stress, anxiety, catastrophic thinking are facilitators**

Chronic pain The Sensitized Nervous System and The Pain Brain

Nociceptive bombardment of the central nervous system results in maladaptive changes that may include:

- Neuroplastic changes in the brain
- Sensitization of the central and peripheral nervous system
- Sympathetic dysfunction

Treating the Pain Brain

Neuroplastic changes, particularly reorganization of the primary and secondary somatosensory cortex and the motor cortex can lead to:

- Pain, including expansion of the area in pain
- Altered body schema: shape/size/temp distortions
- Body Perception Disturbance
- Impaired motor function

Treatment: Graded Motor Imagery¹ found to be the most effective for pain reduction²

- Left/Right Discrimination
- Imagined Movements
- Mirror Therapy³:

Other

- Graded Textures for Desensitization and Sensory Discrimination: decrease allodynia
- Activities across mid-line decrease neglect
- Virtual Reality



1 NOI: Neuro Orthopaedic Institute, Graded Motor Imagery Handbook

2 Daly AE and Bialocerkowski AE 2009 Review: Does evidence support physiotherapy mgmt of adult CRPS type 1.

3 Ramchandran 1992

Not Moving is Not an Option

- Lessons from the Spanish Inquisition
- Consequences of not moving:
 - Muscles: diminished strength and flexibility, potential fibrosis
 - Joints: decreased nutrition, lubrication and range, joint contractures
 - Nerves: restricted glide/elongation
 - Impaired healing and scar tissue organization
 - Sensation: deprivation of movement based and tactile information to the brain can create neuroplastic changes
 - Cardiovascular endurance declines.
 - Circulation to the affected limb is further impaired.
 - Permanent orthopedic disability may occur
 - Increased sensitization of the nervous system: maladaptive neuroplastic changes.

Central Sensitization

A pain response with stimuli that don't normally elicit pain is called **allodynia**; this is the hallmark of central sensitization.

Repetitive stimulation can result in hypersensitization of the nociceptive pathway which can amplify pain by increasing intensity and duration. Once pain is centralized, nociceptive input is no longer necessary to maintain a pain state.

Implications for Treatment: both movement based therapies and neuroplastic challenges should be performed in 5 minute intervals if they amplify pain.

Recommendation: engage in therapeutic activities for 5 minutes, 8-10 times per day.

If you can't do tomorrow what you did today, modify.

Aerobic Exercise & Microglia

Microglia play a complex roll in maintaining the health of the central nervous system and are involved in central sensitization.

CRPS has a neuroinflammatory component related to upregulation of Microglial activity that can cause spreading of neuroinflammation.

Evidence in animal studies point to aerobic exercise as a means of down regulating microglia.

Aerobic activity also affects the role that Microglia play in neuroprotection, making our nervous system more resilient.

Aerobic activity has been shown to reduce depression and decrease the impact of stress.

The Autonomic Nervous System

- This may include sympathetic dysfunction ranging from a deficit of activity (warm dry limb) to overactivity (cold sweaty limb) that can create neuroplastic changes in the brain that amplify stress induced pain
- Nociceptors may fall under the influence of the sympathetic nervous system resulting in pain maintained by the SNS.
- Signs and symptoms associated with these changes vary from person to person.

Treatment: diaphragmatic breathing is a simple but effective way to reduce sympathetic activity. Meditation and relaxation exercises such as body scans can be helpful.

Address Orthopedic impact of CRPS

Identify and treat orthopedic restrictions stemming from the original injury within the pain tolerance of the patient. Prevent further orthopedic restrictions associated with immobility and guarding. Performance of activities will also stimulate the somatosensory cortex.

- Strength
- Range of Motion
- Flexibility
- Cardiovascular Health
- Muscle endurance
- Myofascial Pain

Functional Activities Progression

Patient specific goals starting with BADL independence and progression to IADLs.

- Lifting: multiple levels: boxes, household items, suitcases. Measured in pounds on a weekly basis
- Carrying: Measured in pounds on a weekly basis
- Pushing/pulling: measured in pounds on a weekly basis.
- Ambulation: level/un-level surfaces, up/down stairs and hills: time, distance, speed.
- Transfers: independent or level of assist required
- Body Mechanics: independent, safe with continued cueing, unsafe/poor
- Prolonged postural tolerances: sit, stand, kneel, overhead work: measured in time.
- Pacing: takes appropriate breaks
- Coping tools: uses relaxation, breathing, stretching, MFR, distraction, postural change, positive affirmation, mindfulness appropriately.
- Skill building

Resources

- The RSDSA
 - Online resources at RSDS.org
- Conquer Your Chronic Pain, Dr. Peter Abaci
- The Neuro Orthopaedic Institute
 - Explain Pain Super Charged: David Butler and Lorimer Moseley
 - Graded Motor Imagery Handbook
 - Recognize App for left/right discrimination