Post Stroke Pain Syndromes: Part 1

Hemiplegic shoulder pain, hip pain and knee pain

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- Consultant for Nexstim Corporation
- Grant from NIH testing Sprint Device

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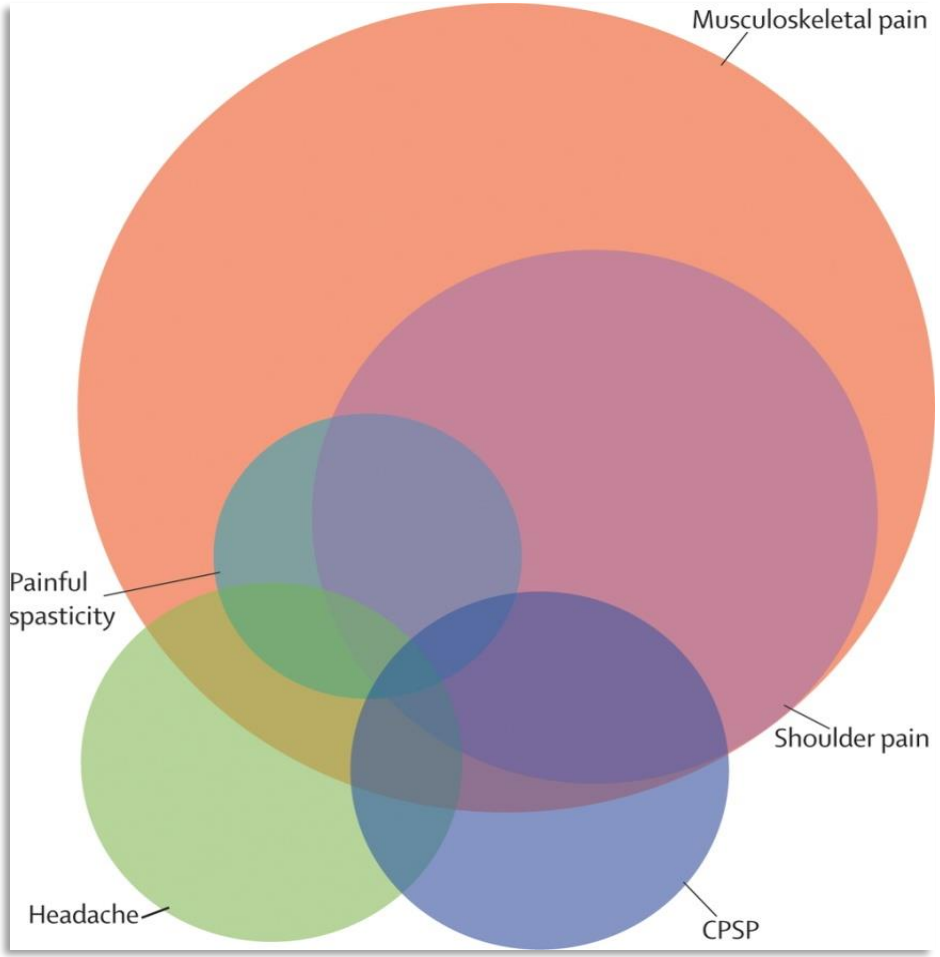
Pain in Stroke

- Joint pain 40%
- Shoulder pain 20%
- Headache 10%
- Central post stroke pain 8%
- Spasticity 7%
- CRPS 1 - rare

Diagnostic Sorting is a challenge



Klit H, et al. Lancet Neurol 2009; 8: 857-68.

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Objectives

- Epidemiology - Prevalence
- Hemiplegic shoulder dynamics
- Causes of shoulder pain
- Management of shoulder pain
- Hip pain
- Knee pain

Hemiplegic Shoulder Pain

- Incidence of 1-22% in the first year
- Prevalence is between 5-84%
- Risk of shoulder pain is associated with shoulder subluxation and motor weakness
- Degree of weakness does not correlate with pain severity
- Cause of hemiplegic shoulder pain is multifactorial

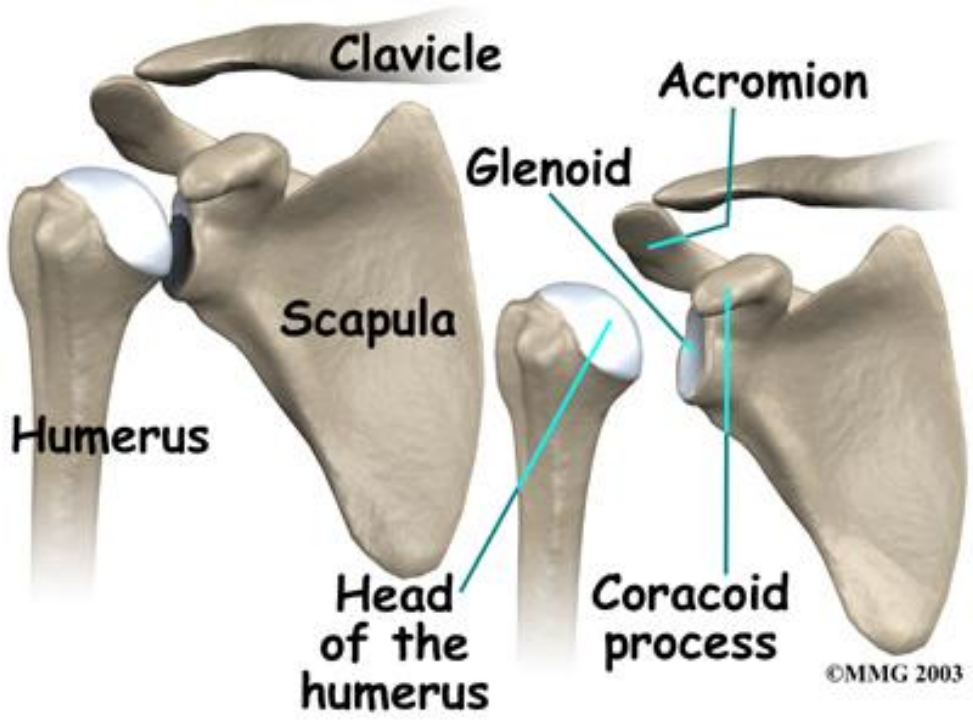
Lindgren, et al. Stroke. 2007; 38: 343
Chae J, et al. Arch Phys Med Rehabil. 2007; 88: 298
Paci M, et al. Physiother Res Int. 2007; 12: 95

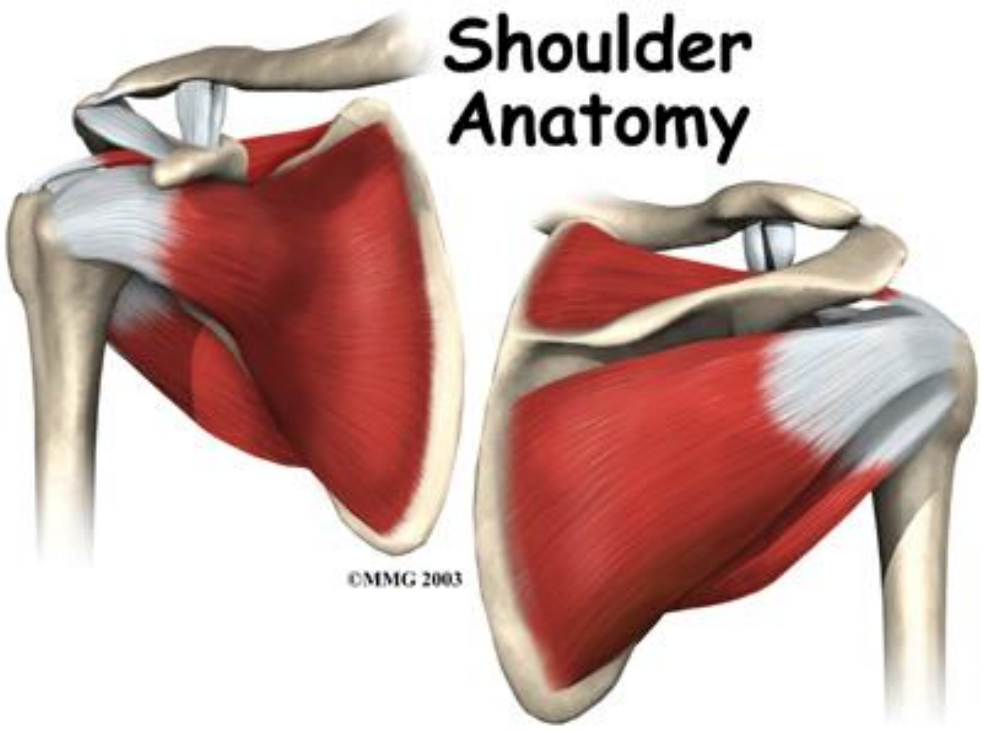
Other Risk Factors

- Older age
- Left hemiplegia
- Tactile extinction and reduced proprioception in the painful limb
- Early complaints of pain
- Reduced glenohumeral range of motion
- Positive impingement on Neer's test
- Tenderness

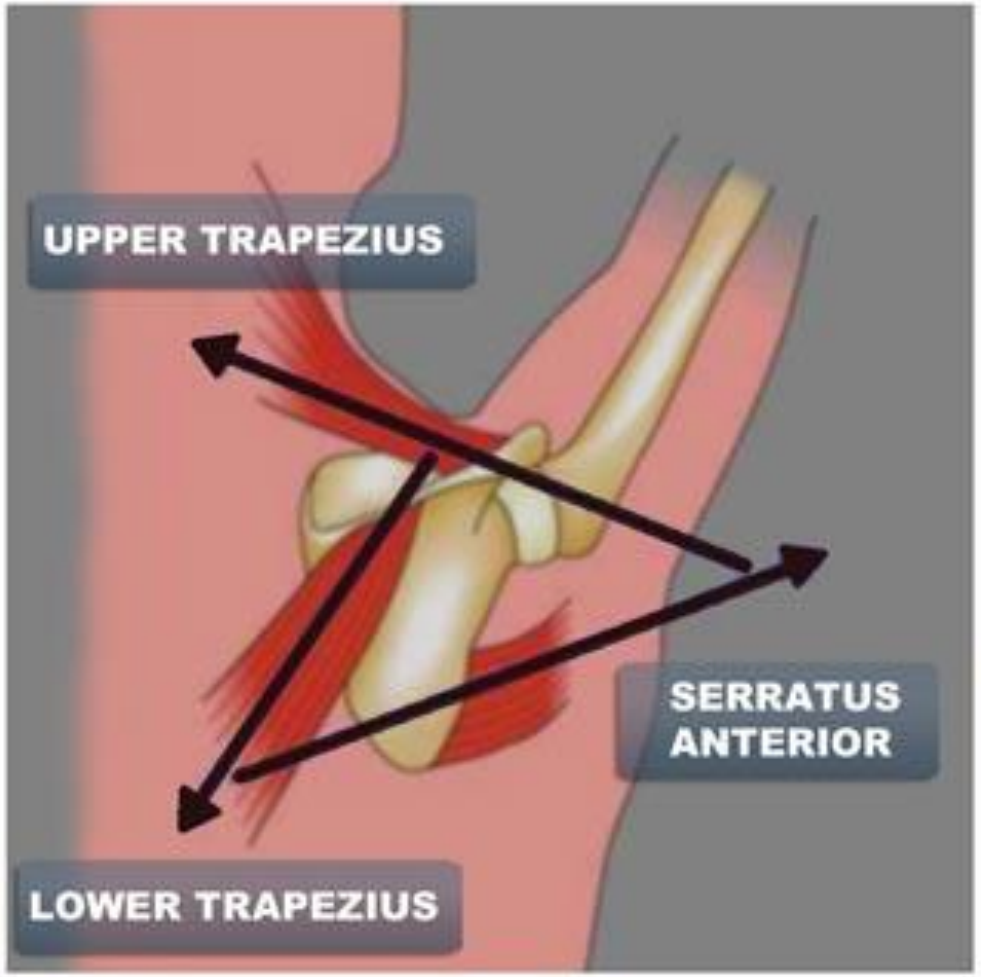
Dromerick AW, Arch Phy Med Rehabil. 2008; 89: 1589

Shoulder anatomy





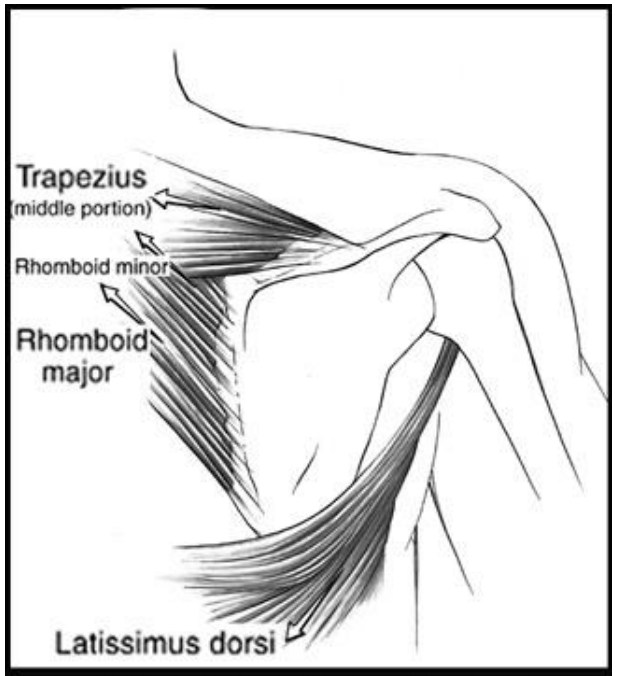
Normal shoulder motion



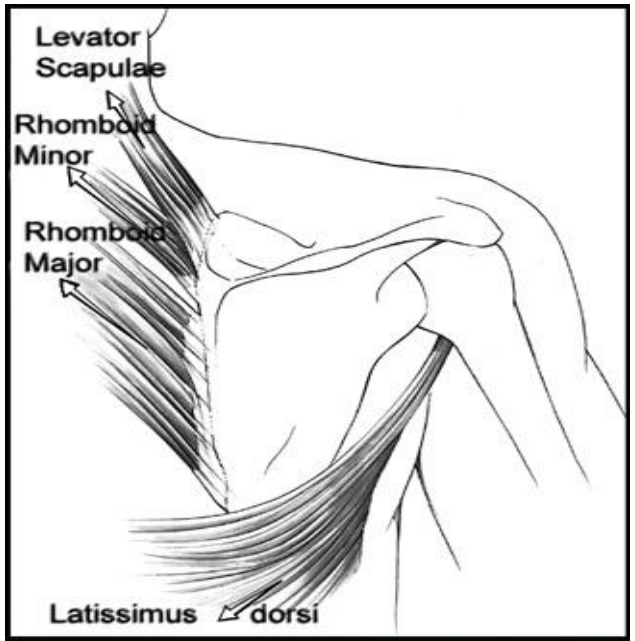
- Shoulder sacrifices stability for motion
- 2:1 ratio of glenohumeral motion to scapular upward rotation
- Scapular rotation is coordinated by normal muscle synergies

In hemiplegia the scapula misbehaves during shoulder abduction

Scapular Retraction AND Downward Rotation



Retraction of the scapula. The trapezius and rhonboidei contract, balanced by serratus anterior and the pectoralis muscles anteriorly.



Downward rotation of the scapula. The rhomboidei and levator scapulae elevate the medial border of the scapula. The lower fibres of pectoralis major, pectoralis minor and latissimus dorsi depress the lateral border of the scapula.

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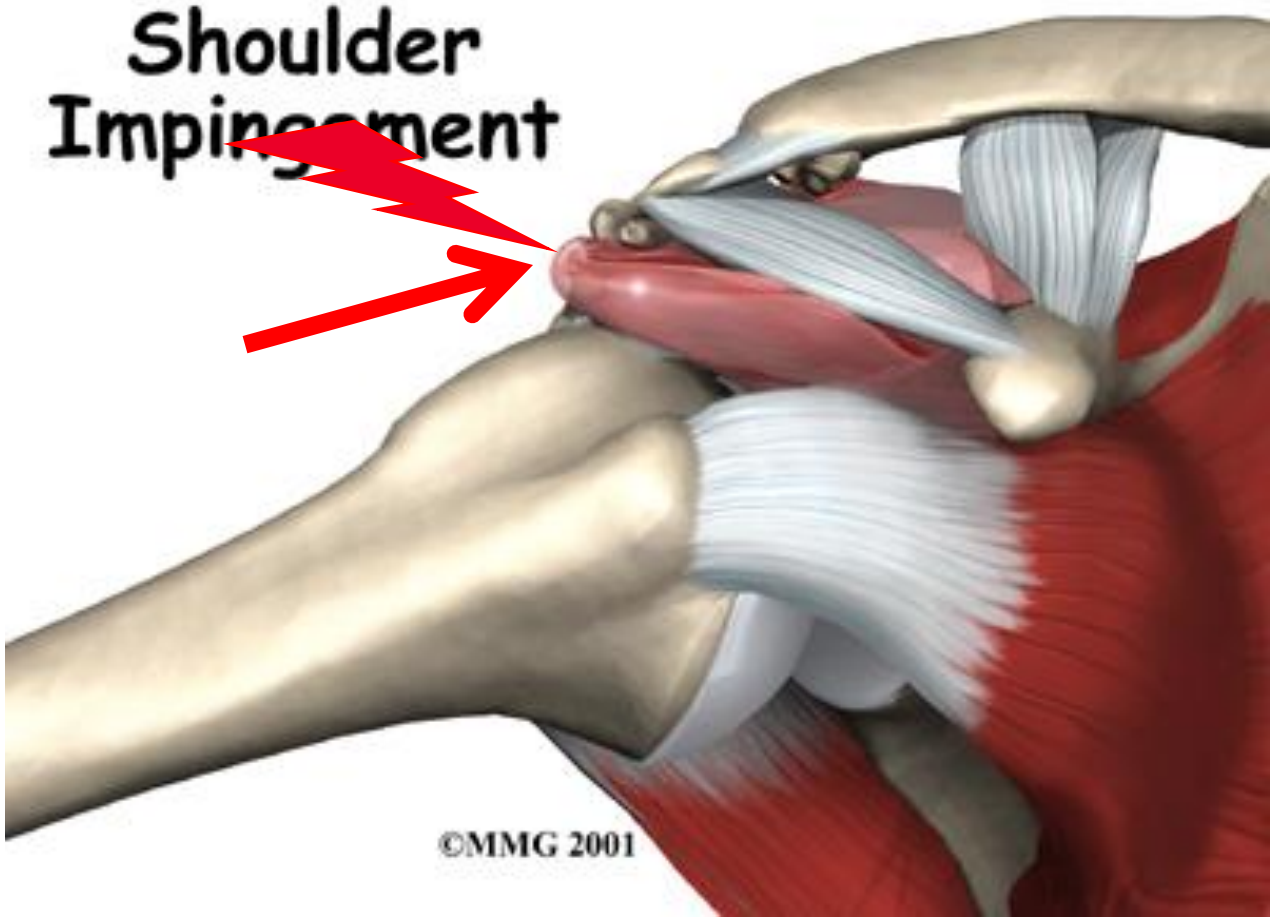
Altered scapular dynamics during shoulder abduction leads to Impingement



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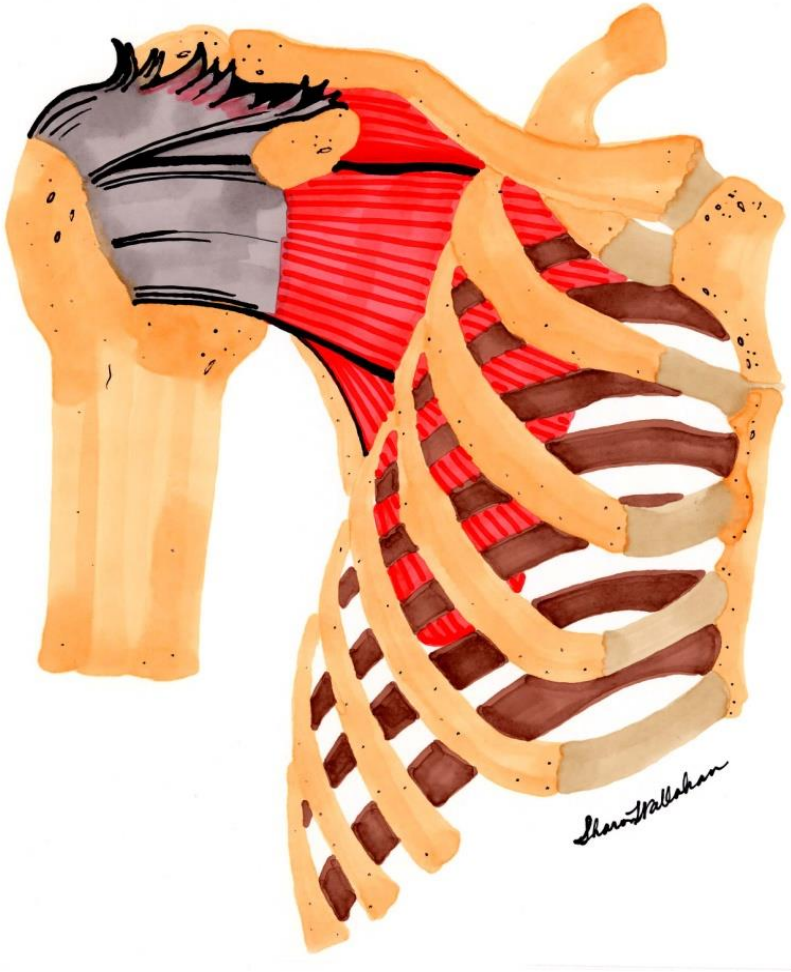
Hemiplegic shoulder

- Instead of impinging at 90° of glenohumeral abduction, it happens at perhaps 30°
- Mechanics are further complicated spastic dystonia resulting in shoulder internal rotation
- Inflammation arises of supraspinatus tendon and subacromial bursa
- The patient gets tired of the pain and protects the shoulder
- Next we see adhesive capsulitis
- AND the scapula becomes firmly fixed to the chest wall.

Hemiplegic shoulder

- Poor sitting posture in the wheelchair contributes to this:
  - Poor fitting chair
  - Sling seat back
  - Lack of arm support
  - Curved thoracic spine
  - Internal rotation of the shoulder
  - Shoulder subluxation and downward rotation of the scapula

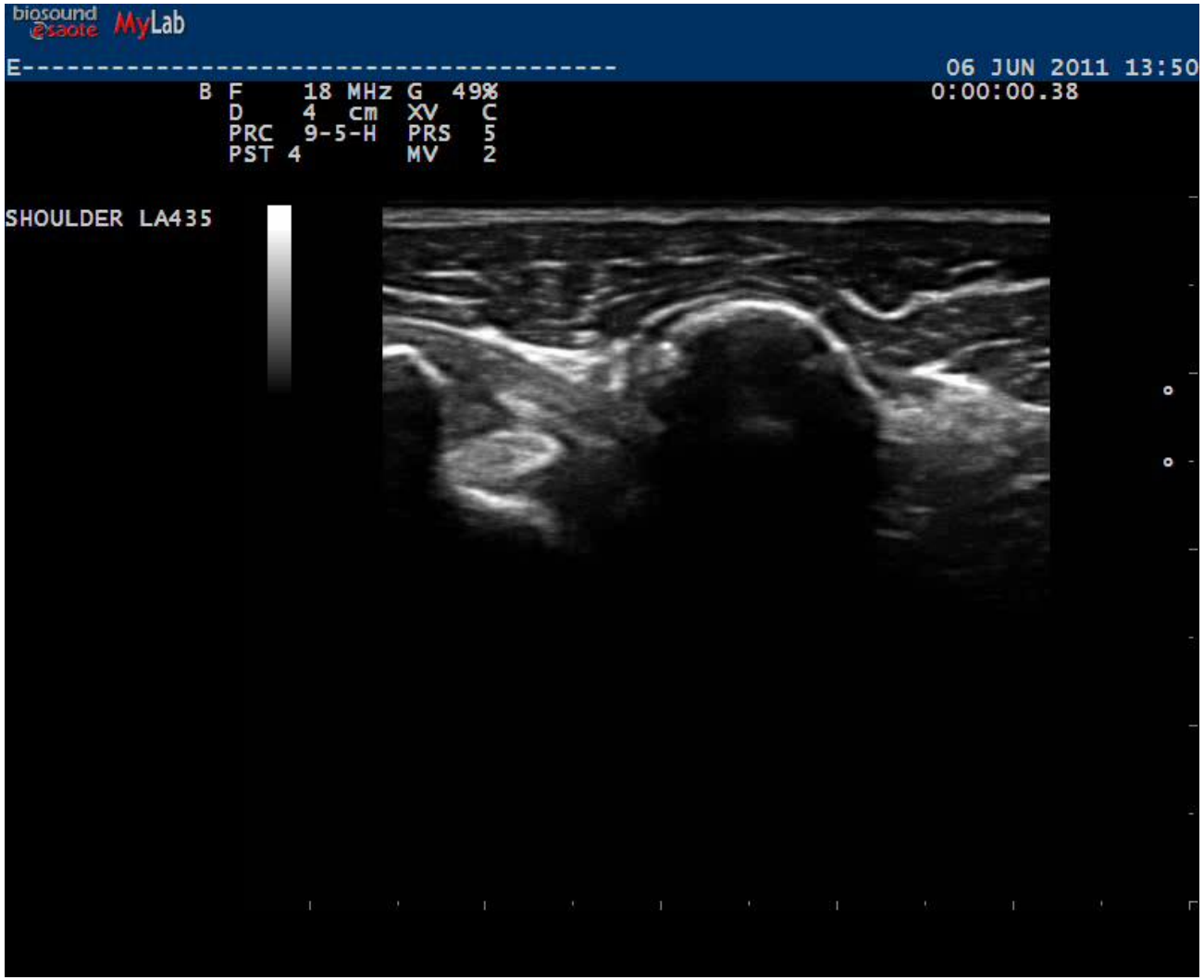
Rotator cuff tears and hemiplegic shoulder



- Rotator cuff tears can contribute to shoulder pain and may be a consequence of impingement
- The incidence of rotator cuff tear in hemiplegic limb is as high as 40% (Najenson et al)
- Others found no relation between hemiplegic arm and rotator cuff tear (Rizk et al, Hakuno et al)

Najenson T et al. Scan J Rehab Med. 1971; 3: 131
Rizk TE, et al. Arch Phys Med Rehabil. 1984; 65:254
Hakuno A , et al. Arch Phys Med Rehabil. 1984; 65: 706

Ultrasound diagnostics and injection



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Ultrasound findings

- 30% of patients will have abnormal findings in hemiplegic shoulder
  - Effusion within biceps tendon sheath or subacromial bursa
  - Tendinopathy of biceps, supraspinatus or subscapularis
  - Rotator cuff tear
- These findings are more common in patients with shoulder pain
- The prevalence of abnormal US findings increase over the course of rehabilitation in those with severe hemiplegia
- In those with pain, the presence of tissue injury is not associated with pain severity
- Patients with movement have more evidence of joint injury than those without movement

Huang YC, et al. J Rehabil Med. 2010; 42: 21
Pong YP, et al. J Clin Ultrasound. 2009; 37: 199

What about Subluxation?

- The role of glenohumeral subluxation in hemiplegic shoulder pain is controversial
- Caused by paralysis in shoulder stabilizing muscles (Rot cuff, deltoid, etc.)
- Tends to occur early after stroke during “flaccid” period (Chaco & Wolf, 1971)
- Often resolves later when spasticity develops.
  - May be seen during sitting but reduces on standing
- Though subluxation is seen early, shoulder pain often occurs later.

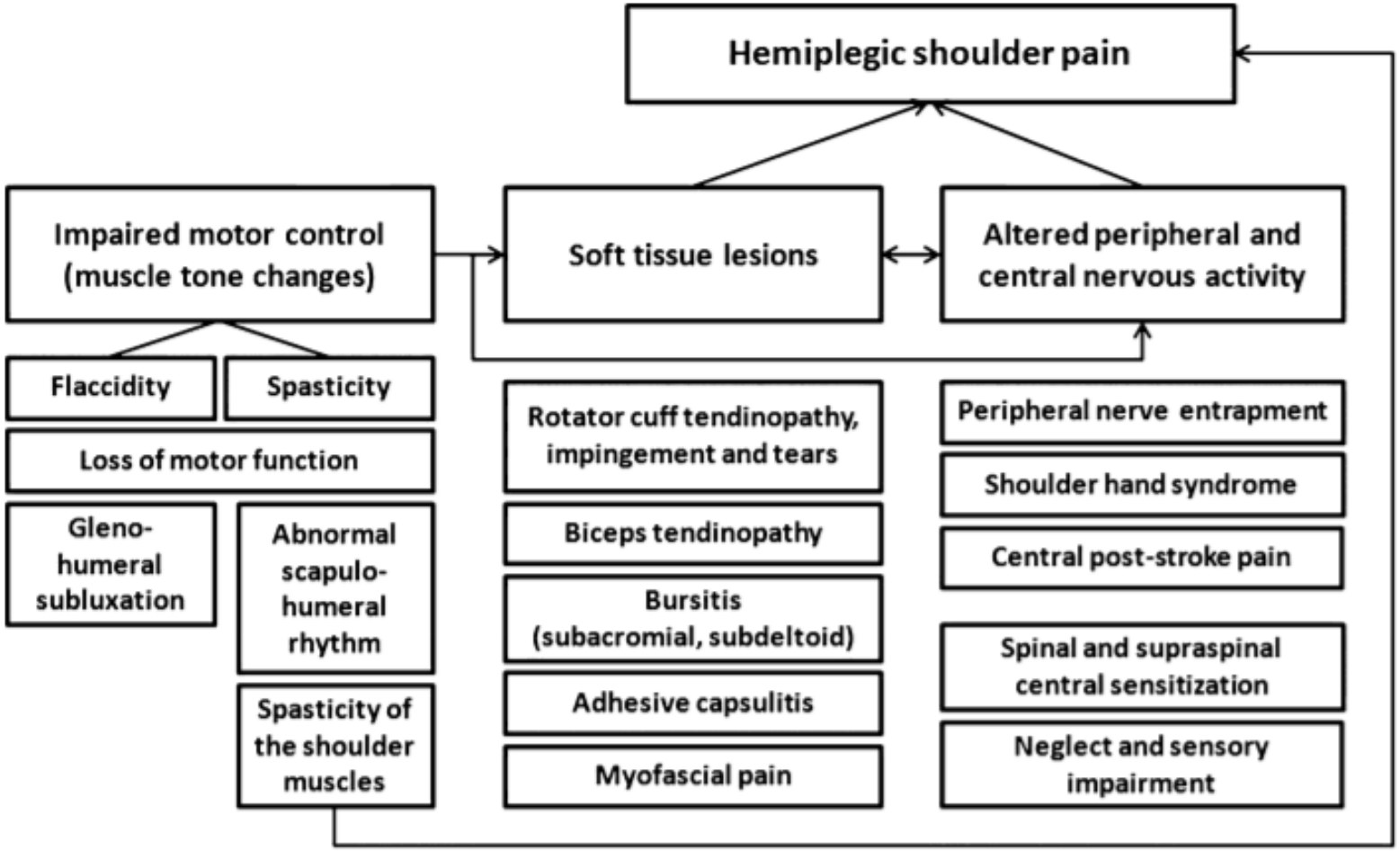
Chaco J, Wolf E. Amer J Phys Med Rehabil. 1971; 50: 139

Subluxation and shoulder pain in stroke

- If unmanaged early, subluxation may result in rotator cuff injury or inflammation
- Most definitely is not THE cause of hemiplegic shoulder pain
- However, it is part of the overall altered mechanics of hemiplegic shoulder that contributes to shoulder inflammation, pain and activity limitation
- Subluxation predicts shoulder pain in the future because both subluxation and pain are associated with more severe hemiplegia.

Wilson RD, et al. Stroke Rehabilitation and Recovery, pp 503-519

A model of shoulder pain in stroke



Kalichman L, Ratmansky M. Am J Phys Med Rehabil. 2011; 90: 768

Treatment

Barney Fife on Hemiplegic Shoulder Pain

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Hemiplegic shoulder management

- Proper positioning (both bed and chair)
- Regular scapular mobilization and proper shoulder ROM
  - Usually requires assist from family
- Use of Acetaminophen, NSAIDs or opioids as needed
- Motor relearning with proper shoulder mechanics
- Botulinum toxin injection for shoulder related spasticity (mixed results)
- Plane x-ray and diagnostic ultrasound for persistent pain, with or without steroid injection (long-term effectiveness of steroids has not been verified).
- Suprascapular nerve blocks – effective up to 12 weeks

Slings? – Swath Style

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Slings? – Upper limb positioning device

- Effective for protecting the shoulder during ambulation

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Slings? – cuff style

- Used only if:
  - There is persistent subluxation
  - There is pain with traction on arm
  - Pain is relieved with reduction of the subluxation

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Arm boards and Trays

Strapping

- Mixed results in clinical trials

Griffin A, Bernhardt J. Clin Rehab. 2006; 20: 287
Hanger HC, et al. Clin Rehab. 2000; 14:370
Grampurohit N, et al. Top Stroke Rehab. 2015; 22: 72-82

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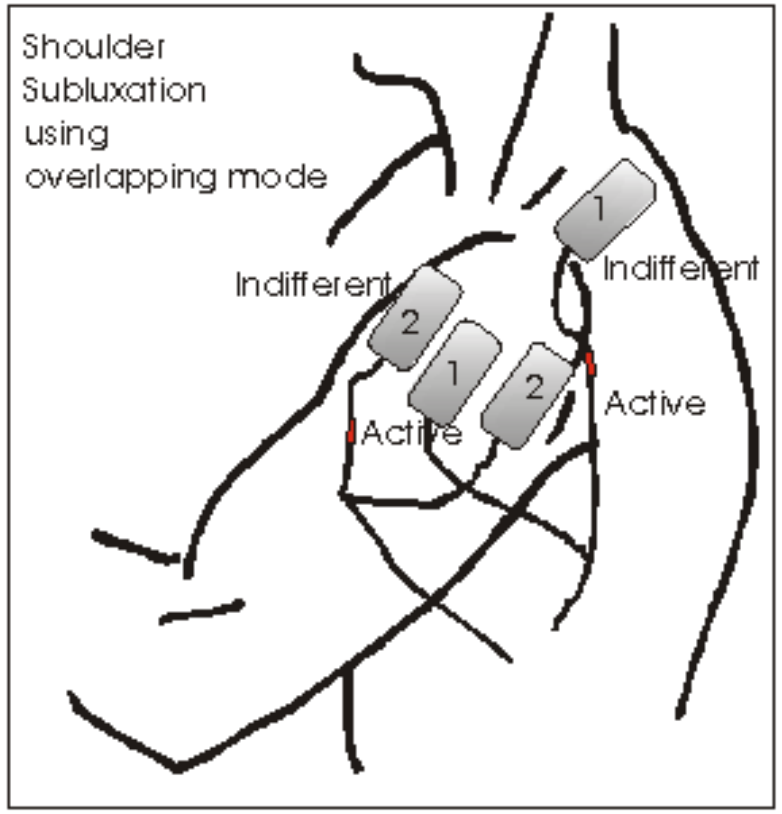
Neuromuscular Electrical Stimulation

- Often used to reduce subluxation
- Given 6 hours daily
- May reduce pain via sensory neural modulation
- May reduce subluxation by muscle hypertrophy



Chantraine A, et al. Arch Phys Med Rehabil. 1999; 80: 328.
Faghri PD, et al. Arch Phys Med Rehabil. 1994; 75: 73

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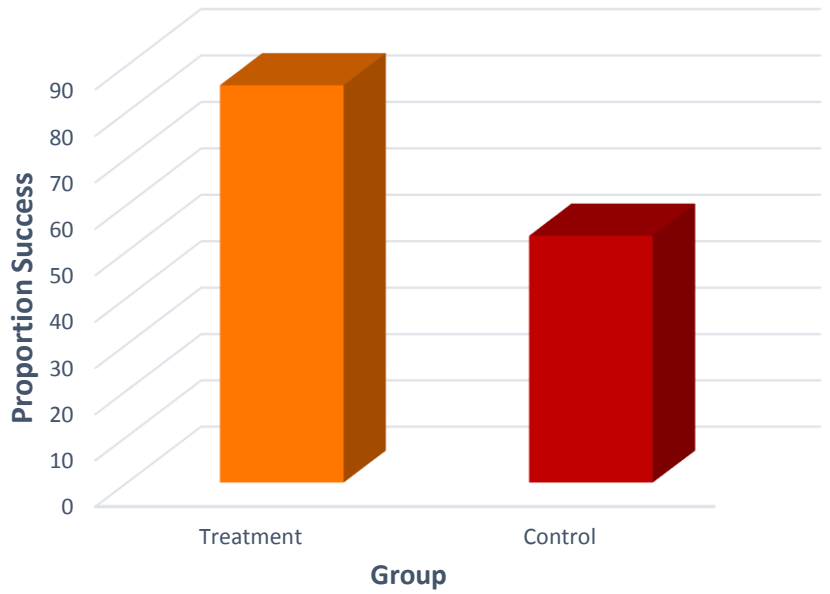
Percutaneous Neuromuscular Stimulator



- Main endpoint of pain reduction failed to meet significance
- Significant success in achieving a 30% reduction in pain interference

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Fully implanted stimulator lead

- For treatment of pain from peripheral nerve origin
- 33% response rate patients with upper limb pain (30% ↓ NRS)

Deer T, et al. Neuromodulation. 2016; 19:91-100

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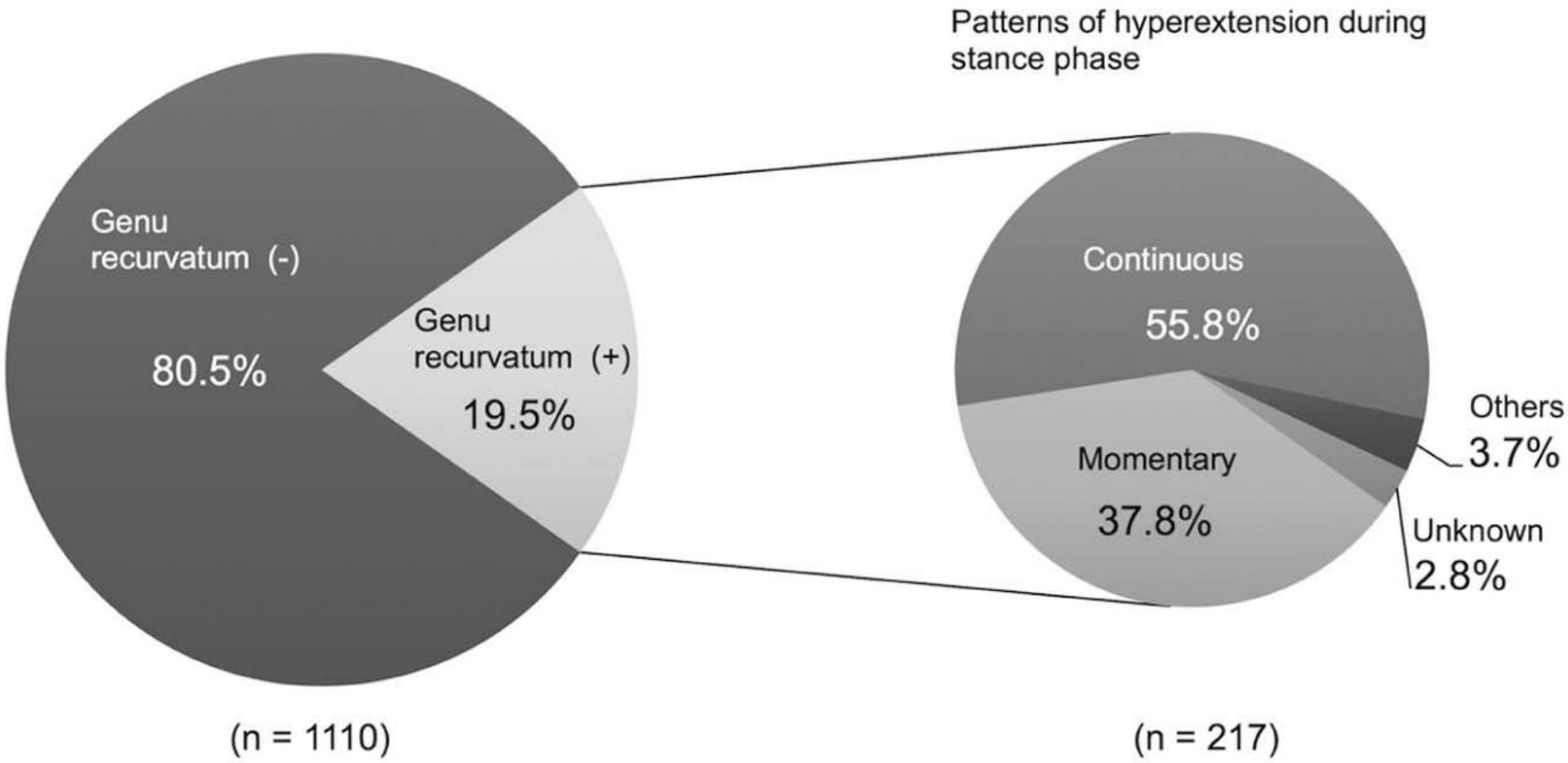
Other joints

Hip pain

- Osteoarthritis is associated with a higher incidence of cardiovascular events
  - Self reported difficulty walking with OA leads is associated with a 30% increased hazard for CV events
- Post-stroke hip pain
  - Less common than shoulder pain
  - Associated with tightness of ileotibial band (prolonged sitting)
  - Can result in trochanteric syndrome
  - Usually responds to stretching, tissue massage and core strengthening
  - On rare occasions, “bursa” injection can help facilitate recovery.
  - Consider presence of a fracture if history of fall

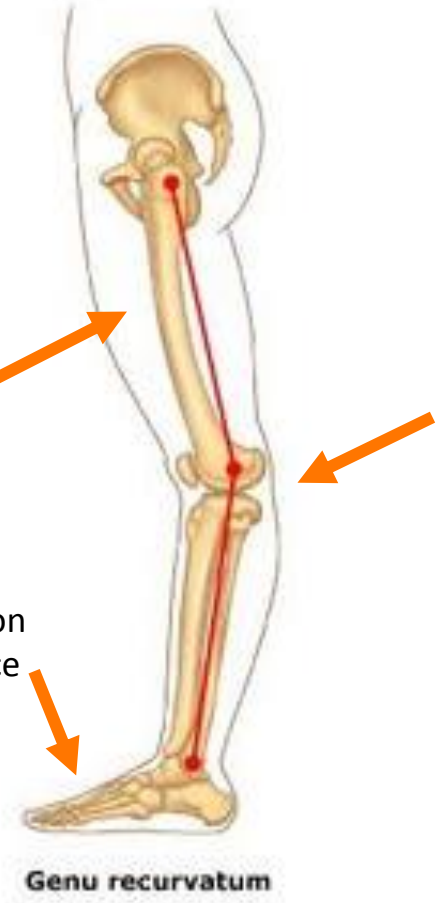
Kendzerska T et al. Osteoarthritis Cartilage. 2017; 25: 1771
Kendall R. Top Stroke Rehabil. 2010; 17: 173

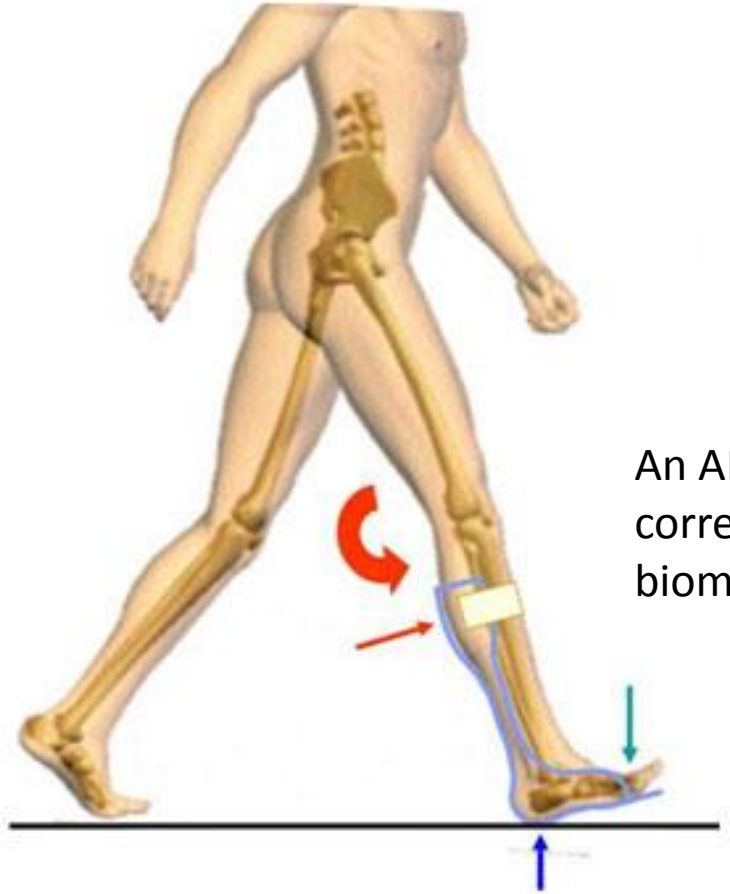
Knee pain



Tani Y, et al. J Stroke Cerebrovasc Dis. 2016; 25: 1153

Knee pain





An AFO can correct knee biomechanics

Kobayashi T, et al. Clin Biomechanics. 2018; 59: 47

Knee pain

Adjustable Plantarflexion Stop

Knee continues to hyperextend early in stance phase of walking

Patient rides back on heel during stance

Knee pain

Genu recruvatum in stance

Heel build up on AFO

Swedish knee cage + AFO

Knee Pain

- KAFO
  - Free motion knee joint
  - Posterior strap as a knee extension stop
- Ankle joint
  - Free motion
  - Plantar flexion stop
  - Solid

Thank you! (part 1)

References

1. Klit H, Finnerup NB, Jensen TS. Central post-stroke pain: clinical characteristics, pathophysiology and management. Lancet Neurology. 2009; 8: 857-868
2. Lindgren I, Jonsson AC, Norrving B, Lindgren A. Shoulder pain after stroke: a prospective population-based study. Stroke. 2007;38:343–348
3. Chae J, Mascarenhas D, Yu DT, Kirsteins A, Elovic EP, Flanagan SR, Harvey RL, Zorowitz RD, Fang ZP. Poststroke shoulder pain: its relationship to motor impairment, activity limitation, and quality of life. Arch Phys Med Rehabil. 2007;88:298–301
4. Paci M, Nannetti L, Taiti P, Baccini M, Rinaldi L. Shoulder subluxation after stroke: relationships with pain and motor recovery. Physiother Res Int. 2007;12:95–104.
5. Dromerick AW, Edwards DF, Kumar A. Hemiplegic shoulder pain syndrome: frequency and characteristics during inpatient stroke rehabilitation. Arch Phys Med Rehabil. 2008;89:1589–1593
6. Najenson T, Yacubovich E, Pikielni SS. Rotator cuff injury in shoulder joints of hemiplegic patients. Scand J Rehabil Med. 1971; 3: 131-137
7. Risk TE, Christopher RP, Pinals RS, et al. Arthrographic studies in painful hemiplegic shoulders. Arch Phys Med Rehabil. 1984; 65: 254-256
8. Hakuno A, Sashika H, Ohkawa T, Itoh R. Arthrographic findings in hemiplegic shoulders. Arch Phys Med Rehabil. 1984; 65: 706-711
9. Huang YC, Liang PJ, Pong YP, et al. Physical findings and sonography of hemiplegic shoulder in patients after acute stroke during rehabilitation. J Rehabil Med. 2010; 42: 21-26
10. Pong YP, Wang LY, Wang L, et al. Sonography of the shoulder in hemiplegic patients undergoing rehabilitation after a recent stroke. J Clin Ultrasound. 2009; 37: 199
11. Chaco J, Wolf E. Subluxation of the glenohumeral joint in hemiplegia. Am J Phys Med. 1971; 50: 139-143
12. Wilson RD, Yu DT, Chae J. Musculoskeletal complications after stroke. In Stroke Rehabilitation and Recovery 2nd Ed. Editors Stein J, Harvey RL, Winstein CJ, et al. Demos Publishing, 2015, New York. Pp. 503-519
13. Kalichman L, Ratmansky M. Underlying pathology and associated factors of hemiplegic shoulder pain. Am J Phys Med Rehabil. 2011; 90: 768-780
14. Grampurohit N, Pradhan S, Kartin D. Efficacy of adhesive taping as an adjunt to physical rehabilitation to influence outcomes post-stroke: a systematic review. Top Stroke Rehab. 2015; 22: 72-82
15. Griffin A, Bernhardt J. Strapping the hemiplegic shoulder prevents development of pain during rehabilitation: a randomized controlled trial. Clin Rehabil. 2006; 20: 287-295
16. Hangar HC, Whitewood P, Brown G, et al. A randomized controlled trial of strapping to prevent post-stroke shoulder pain. Clin Rehabil. 2000; 14: 370-380
17. Chantraine A, Baribeault A, Uebelhart D, Gremion G. Shoulder pain and dysfunction in hemiplegia: effects of functional electrical stimulation. Arch Phys Med Rehabil. 1999; 80: 328-331

References

18. Faghri PD, Rodgers MM, Glaser RM, et al. The effects of functional electrical stimulation on shoulder subluxation, arm function recovery, and shoulder pain in hemiplegic stroke patients. Arch Phys Med Rehabil. 1994; 75: 73-79
19. Deer T, Pope J, Benyamin R, et al. Prospective, multicenter, randomized, double-blind, partial crossover study to assess the safety and efficacy of the novel neuromodulation system in the treatment of patients with chronic pain of peripheral nerve origin. Neuromodulation. 2016; 19: 91-100
20. Kendzerska T, Juni P, King LK, et al. The longitudinal relationship between hand, hip and knee osteoarthritis and cardiovascular events: a population-based cohort study. Osteoarthritis and Cartilage. 2017; 25: 1771-1780
21. Kendall R. Musculoskeletal problems in stroke survivors. Top Stroke Rehabil. 2010; 17: 173-178
22. Tani Y, Otaka Y, Kudo M, et al. Prevalence of genu recruvatum during walking and associated knee pain in chronic hemiplegia stroke patients: a preliminary study. J Stroke Cerebrovasc Dis. 2016; 25: 1153-1157
23. Kobayashi T, Orendurff MS, Hunt G, et al. The effects of an articulated ankle-foot orthosis with resistance-adjustable joints on lower limb joint kinematics and kinetics during gait in individuals post-stroke. Clin Biomechanics. 2018; 59: 47-55

Questions?