# Don't be a "McTherapist!"

Dan Lorenz, DPT, PT, ATC/L, CSCS, USAW

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## What's a "McTherapist?" What's "McTherapy?"

- McTherapy (Mik-ther-a-pee)
  - Rehabilitative practice involving the exclusive use of modalities that don't work or have no evidence supporting their use
  - Not screening for medical conditions
  - Applying a "cookbook" approach to said conditions
  - Treating only the joint in question and not considering other areas that may be involved
  - Teaching/instructing in exercises that reinforce poor movement patterns

***Synonyms: robot, monkey, zombie***

## Why should I worry?

- Several studies have shown that for various, conditions, home-based PT (independent HEP) has shown similar outcomes as those who went for formal, supervised PT
  - Grant et al, AJSM 2010; Grant et al, AJSM 2005; Schenk et al, Arthroscopy 1997; Fischer et al, Clin Orthop 1998
  - Similar studies have found this for frozen shoulder and for TKR
    - Coppola, Collins *Knee* 2009; Mockford et al, *J Arthroplasty* 2008

## How do I avoid being a "McTherapist?"

- Keep up on the evidence
  - APTA "Open Door", PubMed, University libraries

www.ms-se.com
www.ejbjs.org
www.jospt.org
www.apta.org
www.pubmed.com
PT sites – www.rehabedge.com;
www.myphysicaltherapyspace.com

***Evidence-based Medicine***

"The conscientious, explicit, and judicious use of current best evidence in making decisions about the care of an individual patient. It means integrating clinical expertise with the best available external evidence from systematic research."

"Evidence-based practice is the integration of (1) clinical experience and expertise, (2) patient values, and (3) the best evidence (research) into the decision making process for patient care."

Sackett DL, Straus SE, Richardson WS, et al. Evidence-based medicine. Churchill Livingstone: New York. 2004.

## How do I avoid being a McTherapist?

- "Be an expert at the basics"
  - Where DOES iliopsoas insert??
- Have a rule and a reason for what you're doing
- Using only one school of thought to treat patients
  - Have as many tools in the box as you can

## How do I avoid being a McTherapist?

- Share ideas, ask questions
- Practice sound manual therapy interventions
- Use sound exercise principles
- Many companies offer home study CEU's
- Take advantage of continuing education
- Be a salesman/woman and ***EDUCATE*** your patients
- You're doing it today!!!

## A disclaimer…

- Some interventions discussed aren't necessarily contraindicated, nor are they "bad" BUT…
- It's a problem if that's all that is used or if it's performed incorrectly

## Another disclaimer…

- I'd be lying through my teeth if I told you that I always do what I say should be done here!!

## Patient Expectations

- Very thought provoking article recently in *Physical Therapy* by Bialosky et al about patient expectations and how it affects outcomes
- No clinical tools measure this critical aspect
- "We would like you indicate what you ***think*** will occur and not what you ***want*** to occur"
  - Predicted expectations have been found to be more reflective of clinical outcomes

## Example…

- "At the end of 4 weeks of PT, what you do expect will be the pain associated with your low back condition?"
  - What do you expect will be your ability to play golf?

## Conclusions Bialosky et al

- Ideal vs. realistic expectations must be discussed
- Patients given treatments with highest expected benefit had better results
  - Include treatments that the patient expects to improve their condition
- We can strengthen treatment potential if they expect outcomes pre-emptively
  - Pre-op education prior to TKR
- Establish baseline expected recovery
  - After 10 years of back pain, 4 weeks of PT won't do the trick

## McDoctors?

- Shelbourne, JBJS 2010
  - "The Art of the Knee Exam: Where Has it Gone?"
  - 900 patients seen for unilateral knee problem by emergency docs, primary care docs, orthos, and (friggin) chiros
  - Survey of doctors who saw 900 patients for unilateral knee problem

## McDoctors?

- ***Only 63% of orthos exposed the knees for exam***
- ***89% touched the involved knee, 37% touched uninvolved***
- ***Of 22 orthos who didn't touch the injured knee, 16 ordered MRI's***
- In total, 64% ordered X-rays, 51% ordered MRI's
- Only 54% of the total evaluations were done with the knees exposed

## Topics

- Medical screening
- Ankle/foot injuries
- PFPS
- ACL tears
- Low Back Pain
- Cervical Pain
- Shoulder pathologies
- Tendinitis/Tendinosis
- Modalities

## Patient Evaluation

- Direct Access and changes in health care
- We're going to be the "first line of defense"
- We ***MUST*** be able to recognize the possibility of systemic illnesses
  - But we can't be afraid to make that call!!
  - Musculoskeletal conditions can mask as medical conditions

## Medical Screening

- Pain that does not vary and is present at rest, especially if at night
- Pain that doesn't vary with position
- Symptoms that fluctuate with organ function, related to eating or defacation
- Changes in general health
  - Fever, chills, malaise
  - Unexplained weight loss
  - Nausea > 2 weeks duration

## Immediate referral if… Boissonault and Koopmeiners

- Unstable angina and serious arrythmia
- Dissecting aneurysm
- Acute hernia
- Suicide risk
- Loss of body function (cauda equina)
- Black, tarry stools
- Acute increase in HTN
- Ectopic pregnancy
  - Hip, low back or ***SHOULDER PAIN*** (bleeding irritates diaphragm)
- Temporal arteritis

Boissonault and Koopmeiners, *JOSPT* 1994; 20: 50-58

## Prevalence of Co-morbidities

- Most common co-existing conditions:
  - Headache 22%
    - <1% associated w/ serious pathology
  - Hypertension 21%
    - Should we check everyone's BP?
  - OA 18%
  - Depression 15%
    - Emphasize attainable STG's

Boissonault, *JOSPT* 1999; 29: 506-529

## History/Co-morbidities Boissonault

- Most common infections:
  - Sinus infections 15%
  - Pneumonia 11%
- Most common cancers:
  - Skin 4.5%
  - Breast 1.1%
    - Breast and prostate have most spinal metastases

## Good "Rules of Thumb"…

- Anyone with neck and trunk pain with a history of cancer should be considered to have pain of metastatic origin unless proven otherwise
- Back pain at the same level as abdominal pain, either simultaneously or alternately, is suspicious
- Pain radiating to mid-thoracic spine, scapula, and R shoulder are due to splanchnic nerves that share w/ phrenic nerve (C3-5)

## Maybe the best rule…

- We should be able to provoke the pain through the exam and/or affect it by treatment
  - If not, it is likely not a PT problem!!!

## Pain: Pelvic and Abdominal Disorders

- Most have segmental innervation w/ some exceptions
- Disease in the reproductive or urinary systems refer to the thoracolumbar, lumbar, sacral, and medial groin/thigh
- Digestive system referral patterns from sternal region to sacral/pubic region
  - Liver refers to R shoulder/C-spine
  - Lung refers to L cervical spine/upper trap/shoulder

## Pain Description

- Pulmonary
  - Usually sore throat, wheezing, coughing, dyspnea
- Cardiovascular
  - Pressure-like, aching, throbbing, cramping, aching

## Interview Boissonault

- Pain provocation
- Quality of pain
- Region/Radiation
- Severity
- Timing

** **"PQRST"**

## Symptom history

- Suspect pathology if:
  - Symptoms are truly insidious
  - Symptoms occur insidiously during treatment period
  - Symptoms that subsided or returned for no reason

## Symptoms that need further exam

- Fever/chills/sweats
  - Infection, cancer
- Unexplained weight change – GI issues
- Malaise
- Nausea
- Bowel dysfunction
- Numbness
- Weakness
- Syncope
- Dizziness/Light-headed
- Night pain
- Dyspnea
- Dysuria
- Urinary frequency changes
- Sexual dysfunction

## Which system to screen?

- L/R shoulder pain:
  - Cardiovascular
  - Pulmonary
  - GI
- Thoracic spine pain:
  - Cardio/peripheral vascular
  - Pulmonary
  - GI
  - Urogenital

## Which system to screen?

- R/L knee pain:
  - Peripheral vascular
- Lumbo-pelvic pain:
  - GI
  - Urogenital
  - Peripheral vascular
- Inconsistent patterns:
  - Psychologic
  - Endocrine
  - Neurologic
  - Rheumatic

## Skin Lesions

- Asymmetry
- Borders
- Color
- Diameter
  - Malignant >6mm**

## COMMON CONDITIONS…NOW THAT WE'RE FAIRLY CERTAIN NOTHING "FISHY" IS GOING ON

## Ankle/Foot PT: McTherapy

- Theraband exercises
  - Are we thinking about what directions?
- Ice and stim
  - What are our parameters if we use it?
- Balance exercises
  - What's your algorithm to progress?
- Ultrasound
  - How are you applying it?
- Gait
  - Are they limping?

## What about X-rays?

- Ottawa Ankle Rules Stiell
- Rules would have reduced necessity for ankle and foot x-rays by 46% and 79%, respectively Springer
  - Radiographs indicated when:
    - Bone tenderness at the posterior edge or tip of the lateral or medial malleoli
    - Tenderness over navicular or base of 5th metatarsal
    - Inability to bear weight both immediately after injury and during the exam

## Skilled Therapy

- Normalize gait prior to D/C of assistive device
- Evaluate for posterior talar glide/ant position of lat malleolus
  - Hubbard et al, *JOSPT*, 2006
  - Vicenzino et al, *JOSPT*, 2006
  - Denegar et al, *JOSPT* 2002
  - Collins et al, *Man Ther* 2004
- Evaluate proximal hip strength
  - Bullock-Saxton, *Phys Ther* 1994
  - Bullock-Saxton et al, *Int J Sports Med* 1994
  - Friel et al, *J Ath Train*, 2006

## Skilled Therapy

- Do total leg strengthening as part of therapy
- Balance ex's ***bilaterally***
- Have a sound algorithm for balance progression

## Ankle Instability

- Meta-analysis of balance impairments and ankle instability
- FAI is associated with poorer balance regardless if assessed w/ static or balance tests
- Significant differences in time to stabilization with dynamic tests

Arnold et al, MSSE 2009; 41: 1048-1062.

## Balance and Ankle Sprains

- Meta-analysis of balance capabilities after lateral ankle sprains
- Postural control impairments are present in those with ankle injury
- Balance training improves postural control after injury

Wikstrom et al, *MSSE* 2009; 41: 1287-1295.

## Balance Assessment

- Star Excursion Balance Test (SEBT)
  - Olmstead et al, JAT 2002; 37: 501-506
- "Y" Balance Test
  - Plisky et al, NAJSPT 2009; 4: 92-99.
- Single leg balance test
- Single leg jump landing
- M/L hops

** Measure time to stabilize or errors in performance

## Role of Peroneus Longus

- Theorized that with an inversion stress, the stretch reflex in the peroneus longus should cause eversion of the ankle "pull it back up to neutral"
- Delayed PL activation may be risk factor for sprain
- With repeated sprains, ability to activate the PL will be impaired further

## Role of Peroneus Longus

- Meta-analysis of evertor strength differences and FAI
- FAI resulted in weaker ankles than those with stable ankles, regardless of slow or fast speeds

Arnold et al, JAT 2009; 44: 653-662

## PFPS: McTherapy

- Quad sets, SLR, SLR w/ IR/ER
  - Not validated – Davies et al, *Physio Canada* 2001
- Stretching of quads alone
  - What about gastroc/soleus? Hip flexors? Hamstrings?
- Ball squats w/ adduction
  - WHY??
  - Coquiero et al, *J Electromyo Kines* 2005; Earl et al, *JEK* 2001
  - Song et al, *PT Journal*, 2009
- Ice and stim
  - Why?

## Skilled Therapy

- Assess the foot/orthotics
  - Gross, *JOSPT* 2003; Sutlive *Phys Ther* 2004
- Assess hip rotation ROM
  - Cliborne et al, *JOSPT* 2007; Currier et al, *Phys Ther* 2007
- Myofascial release of the ITB
- Proximal hip strengthening
  - Ireland et al, *JOSPT* 2003
  - Niemuth et al, *CJSM* 2005
  - Fredericson, *CJSM* 2000
  - Arokoski et al, *J Rheumatol* 2002
  - Mascal et al, *JOSPT* 2003
  - Wilson et al, *MSSE* 2006

## Skilled Therapy

- Stretching of the quads, hamstrings, calves, hip flexors
  - Piva et al *JOSPT* 2005
- Consider using bracing or taping
  - Aminaka et al, *JOSPT* 2005; Salsich *JOSPT* 2002
- Lumbopelvic manipulation??
  - Cook et al, *JOSPT* 2008; Iverson et al, *JOSPT* 2008
- Teach pain management strategies

## Summary of PFJ Biomechanics

- For ***OKC ex's, safest range is 70°-100° or 30°-0°***
- For ***CKC ex's, safest range is 0°-45°***
- Quadriceps has to exert most force from 15°-0°, and the compressive forces on the patella decrease from 30°-0° Woodall
- ***Best position to begin isometrics is approximately 20° flexion*** because the patella centralizes in the femoral sulcus in this position Woodall

## Leg Press and PFPS

Steinkamp et al, *AJSM* 1993

- 30°-0° - *lowest* PF joint reaction forces
- 90°-60° - *highest* PF joint reaction forces

## OKC vs. CKC Exercises

Bolgla and Malone, *J Sport Rehab* 2005

- Review article on interventions for PFPS
- *Evidence exists to support the use of OKC, CKC, and isokinetic exercises*
- Biofeedback and patellar taping independent of exercise has limited evidence supporting their use

## ACL Reconstruction Rehab: McTherapy

- Single plane strengthening
  - Is any activity performed only in the sagittal plane?
- Balance exercises on only the involved limb
  - Do they only have one leg?
- "Just following the protocol timeline"
  - When are they REALLY ready??
- No functional testing or algorithm for discharge
  - How do you know??

## Skilled Therapy

- Teach the proper QS and SLR w/o a quad lag
- Normalize gait prior to D/C of assistive device
- Eccentric exercises
- Balance ex's bilaterally
- Manual therapy to restore rotational kinematics
  - Yoo et al, *AJSM* 2005; Pappannagari et al, *AJSM* 2006
- Objective strength measures prior to progression
- Functional testing measures prior to D/C
- Teach proper landing/jumping/cutting mechanics
- Russian stim??
  - Snyder-Mackler et al, JBJS 1995

## Pre-Op ACL "Skilled PT"

Cosgarea et al, *AJSM* 1995

- Incidence of arthrofibrosis following surgery was much lower if:
  - Surgery was delayed at least 3 weeks
  - Patient had pre-op extension of 10° or better
  - If pt placed in post-op brace in full ext with ROM beginning within 24 hours
- Three goals prior to surgery:
  - Must eliminate as much swelling as possible
    - Only 100 cc's of fluid needed to shut off the quad!!
  - SLR without a lag
  - Should have 120° of knee flexion

## Allograft vs. Autograft

- Tibor et al, *Sports Health* 2010
  - Meta-analysis of over 5000 studies!
  - *Allografts were more lax when assessed by the KT-1000*
  - For all other outcomes, no statistically significant difference

## Rehab Paradox

- 30°-0° is highest quad activity of any range
- 30°-0° is most stressful on the ACL in an open chain position, yet it's the least stressful on the ACL in closed chain

## Eccentric Exercise and ACL

Gerber et al, *JOSPT* 2006

- Case study involving implementation of negative work eccentric ergometry after ACLR to investigate return of quad strength
- Began three weeks after surgery
- ***Quad volume increased by 28% in the involved LE*** during 12 week program
- Eccentric exercise may eliminate muscle size and strength deficits

## Eccentrics and ACL

Gerber et al, *JBJS* 2007

- Three weeks post-op, patients either in 12 week eccentric or standard program for ACL reconstruction
- ***Volume and peak CSA of quads and GMax in eccentric group improved significantly*** more in the eccentric group

## Eccentrics and ACL

- Gerber et al, *PT Journal* 2009
  - RCT of subjects w/ ACL reconstruction at 1 year of follow up
  - Standard rehab vs. eccentric program
  - *Quad and gluteus max muscle volume in the involved limb were significantly greater in eccentric group*
  - *Improvements in quad muscle strength and hopping distance were significantly greater in eccentric group*

## Low Back Pain: McTherapy

- Massage
  - What specifically?
    - Massage helpful if ***combined w/ exercise and education***
      - Furlan et al, Cochrane Review 2003
- Stim and heat/ice
  - Parameters?
- Stretching
  - What specifically?
- "Core" strengthening
  - What's your definition of core?

## Skilled Therapy

- Understand subjective complaints and their relation to tissues involved
  - Instability vs. disc vs. degenerative changes
- Teach pain management strategies
- Teach body mechanics/ergonomics
- Screen the hip for SIJ pain
  - Cibulka, *Spine* 1998; Cibulka *Phys Ther* 1992; Warren, *J Man Manip Ther* 2003
- Assess hip rotation ROM
  - Ellison et al, *Phys Ther* 1990; Vad et al, *AJSM* 2004; Mellin, *Spine* 1988; Offierski, *Spine* 1983
- "Look downstairs and upstairs"

## SUMMARY OF LOW BACK/CORE

- Hides et al, *JOSPT* 2008
- Hodges & Richardson, *Spine* 1996
- Hodges & Richardson, *Phys Ther* 1997
- Ferreira et al, *Spine* 2004
- Hodges & Richardson, *Arch Phys Med Rehabil* 1999
- Hides et al, *Spine* 2004
- Barker et al, *Spine* 2004
- Van Dillen et al, *JOSPT* 2001
- Hides et al, *Spine* 2006
- Richardson et al, *Spine* 2002
- Teyhen et al, *JOSPT* 2005
- Hides et al, *Spine* 2001

## "Cliff's Notes"

- Decreased CSA of multifidus and TA
- Hallowing/Drawing in better than bracing
- TA activated in "feed-forward" manner in subjects without LBP whereas those w/ LBP have delayed
- TA activated in anticipation of upper/lower limb movements

## Myofascial Systems

Anterior Oblique System
- External Oblique and *opposite* Hip ADDuctors

Posterior Oblique System
- Latissimus Dorsi and *contralateral* Glute Max

Lateral System
- AB/Adductors of one leg and *contralateral* QL

Deep Longitudinal System
- Fascial connections with great toe, peroneus longus, biceps femoris, sacrotuberous ligament, and back extensors

## Spinal Stability Systems

- GLOBAL MUSCLE SYSTEM
  - Torque-producing muscles that act on the trunk
  - Provide stabilization but not segmental influence
  - RA, EO, Erectors
- LOCAL MUSCLE SYSTEM
  - Attach to lumbar vertebrae and provide segmental stability
  - Multifidus, TA, IO

## Spinal Stability Rehabilitation

- The exercise format for stabilization emphasizes both *strength and endurance* as well as addresses *proprioception*
- Patients w/ LBP have selective wasting of Type I fibers Mannion et al, J Orthop Res 1997
- Lumbar stabilizing mm are mainly type I Thorstensson & Carlson 1987
  - Only low loads needed

## Cervical Pain: "McTherapy"

- Hot packs, ultrasound over the "knots", massage
  - It feels good, but what's it ***fixing***?
- Stretching of the UT/levators and pecs
  - Look at Janda's "Upper Crossed Syndrome"
- Traction
  - Over the door or supine? BIG DIFFERENCE!!

## Headaches Jull

- Cervical spine headaches:
  - Pressure on trigger points precipitate headaches
  - Cervical pain
  - Decreased cervical ROM
  - ***Unilateral symptoms***
  - Ipsilateral shoulder or UE pain
  - Sensitive to sustained cervical flexion

## Headaches and Nervous System

- Clinician should worry if:
  - HA worsens w/ exertion/activity
  - Sudden, immediate or severe
  - Intense pain over sinus or teeth
  - HA's that begin after laying down
  - HA's associated w/ vomiting and no nausea
  - HA's that begin/remain as unilateral pulsating
  - Focal tenderness over temporal artery in pt >60
  - Sudden, intense, lancinating pain

## Cervical Spine Janda

- Neck contains 80% afferent fibers (other muscles about 50%)
  - Greater sensitivity of the neck to any situation which alters proprioceptive input
- Neck-shoulder muscle complex is largely controlled by the limbic system
- Increased muscle tone due to impaired function of the limbic system
  - Why stress can cause higher neck muscle activation

## Skilled Therapy

- Screen/treat the thoracic spine and ribs
  - Cleland et al, *Phys Ther* 2007; Gonzalez-Iglesias JOSPT 2009
- Strengthen: deep cervical flexors, interscapular muscles, upper traps
  - Ylinen et al, *J Strength Cond Res* 2006
  - De-Las-Penas et al, *JOSPT* 2008
  - Cleland et al, *JOSPT 2005* – traction, strengthening, manual tx
  - Falla et al, *Phys Ther 2007* – deep cervical flexors

## Skilled Therapy

- Stretch: pec major/minor, short cervical extensors
  - Johnston et al, *Spine* 2008
    - Workers w/ neck pain had decreased rotation, increased rotation of superficial cervical flexors, increased activity of cervical extensors; UT, extensors and scalenes "couldn't relax"
- Teach management strategies
- Assess breathing – chest breather or diaphragmatic breather?
- Teach posture, body mechanics, ergonomics

## Muscle Activity and C-Spine Pathology

- Females w/ bilateral chronic neck pain had generalized smaller CSA of the cervical multifidus compared to healthy controls
  - Fernandez-de-las-Penas et al, *J Orthop Sports Phys Ther.* 2008; 38(4): 175-180.
- Neck pain has been associated w/ altered patterns of activity of the superficial neck flexors
  - Hanney et al, *Strength Cond Jour.* 2007; 29(3): 78-83.

## FYI – Neck Pain Clinical Practice Guidelines

- ***Use cervical manipulation/mobilization to reduce neck pain and headaches***
- Thoracic spine thrust/non-thrust can be used to reduce neck pain and neck-related arm pain
- Stretch: Scalenes, UT, LS, PMaj/PMin
- ***Strengthening and endurance exercise***
- Upper quarter nerve mobilizations
- Traction
- ***Patient education and counseling***

Childs et al. Neck pain…*JOSPT*. 2008; 38(9): A1-A34.

## Hooray for PT's!

- RCT of manual therapy, physical therapy, or GP care for patients w/ neck pain
- At 7 weeks, success rate for manual therapy was 68%, 51% for physical therapy, 36% for GP care
  - Hoving et al, *Ann Intern Med* 136: 713-722, 2002

## Cervical Spine PT

- Case series of patients w/ cervical radiculopathy involving manual therapy, cervical traction, and strengthening exercises of the deep neck flexors and scapular stabilizers
- 91% reported clinically meaningful improvement in pain and function w/ a mean of 7 PT visits and at the 6 month follow up
  - Cleland et al, *J Orthop Sports Phys Ther.* 2005; 35: 802-811.

## C-Spine=A bunch of knees stacked on top of each other!

- Chondrocytes and synoviocytes were found in a histological study of the uncovertebral joints, suggesting they are synovial in nature
- They are potential pain generators in the cervical spine due to presence of nerve fibers
  - Brismee et al, *Spine.* 2009; 34(12): 1257-1263

## Cervical Spine "Nuggets"

- Orientation of facets is 45 +/- 18
- Translation over cervical discs
  - "Rocking" in lumbar
- Uncinate processes provide stability via "trough effect"
- Osteophytes on X-ray indicate that there was instability ***at one time***
- Cervical discs are dry and flaky
  - Not as much water as lumbar

## Cervical Spine Biomechanics

- C0-C2 – SB/ROT opposite
  - Atlas moves in same direction as occiput
- C3-7 – SB/ROT same
- 95% of subcranial rotation is AA joint
- 50% of cervical spine rotation is AA joint

## Recipe for successful cervical rehab with/without radiculopathy

- Posture/ergonomics education
- Restore mobility of subcranial cervical spine and lower cervical/upper thoracic spine
- Improve strength of deep cervical flexors and interscapulars
- Improve cervical upglide/downglide

## Shoulder pathologies: McTherapy

- Rotator cuff strengthening
  - What positions? What's the progression?
- Reinforcing improper mechanics of elevation
  - Normals don't shrug
- Treating only the shoulder
  - What about the cervical and thoracic spines?
  - Is there a hip/shoulder connection?
    - "Serape effect"

## Skilled Therapy

- Assess isolated GH IR – "GIRD"
  - Lintner et al, *AJSM* 2007
  - Skolimowski et al, *Orthop Trauma Rehabil* 2008
  - Borich et al, *JOSPT* 2006
  - Turves et al, *AJSM* 2009
  - Warner et al, *AJSM* 1990
  - Wilk et al, *Orthopaedics* 1993
- Assess/treat thoracic spine and rib mobility
- Assess/treat joint restrictions
- Teach proper posture
- Teach lifestyle modifications

## Skilled Therapy

- May need to start in gravity eliminated positions
- Focus on interscapular and posterior rotator cuff
  - "Posterior dominant shoulder"
- Screen the cervical spine!!
- Screen the hips

## Tendinopathies: McTherapy

- Ice/heat and/or stim
  - How do we know it's even an "itis"?
- Ionto
  - Again, do we know it's actually inflamed?
- Ultrasound
  - Parameters?
- Cross Friction Massage
  - Why?
- Stretching
- Strengthening
  - What? Other joints may need it?

## "Tendon Paradox"

Oxygen consumption is ***7.5X lower*** in tendons/ligaments than skeletal muscle; low metabolic rate and anaerobic energy generating capacity are needed to carry loads and maintain tension for long periods, thereby reducing risk of ischemia. However, ***low metabolic rate*** results in ***slow healing*** after injury Williams, 1986

## Skilled Therapy

- Know the difference between tendonosis and tendonitis
- Help the patient remove the aggravating stimulus/teach management strategies
- Assess faulty mechanics
- Assess intrinsic/extrinsic risk factors for injury
- Use eccentric training
- "EdUReP" – Davenport et al, *Phys Ther* 2005

## Tendonitis vs. Tendonosis

- *Acute – sharp, localized* pain in the AM or after long rest because lack of activity resulted in fluid stasis, leading to chemical irritation of nerve endings
- *Chronic* – fairly constant, *dull, poorly localized* ache that worsens with activity

| ***Stage*** | ***Diagnosis*** | ***Macroscopic Pathology*** | ***Histologic Findings*** | ***Clinical Signs*** |
|---|---|---|---|---|
| **0** | Healthy | No inflammation | Organized collagen, absent blood cells | Firm tendon, not painful, absent swelling, normal temp |
| **I** | Acute tendinitis | Symptomatic tendon degeneration; ↑ cellularity, vascular disruption; inflammation of paratenon | Degenerative changes w/ microtears, inflammatory cells in paratenon, focal collagen disorientation | Acute swelling, pain, local tenderness, warmth, dysfunction |
| **II** | Chronic tendinitis | ↑ tendon degeneration and vascularity | Greater evidence of microtears, ↑ levels of collagen disorientation in tissue hypercellularity | Chronic pain w/ tenderness, ↑dysfunction, person voluntarily unloads structures |
| **III** | Tendinosis | Intratendinous degeneration due to microtrauma, cellular/tissue aging, vascular compromise | ↑ cellularity, neovascularization, focal necrosis, collagen disorientation and disorganization | Palpable tendon enlargement, swelling of tissues, ↑ dysfunction w or w/o pain, tendon sheath may be swollen |
| **IV** | Rupture | Tendon failure | Complete disruption of fibers | Weak and painful muscle testing, inability to move affected joint, + clinical tests for tendon disruption |

Nirschl, Clin Sports Med 1992

| | TENDONITIS | TENDONOSIS |
|---|---|---|
| Inflammation? | Yes – macrophages, PML | No |
| Collagen | Healthy, vascular tissue, parallel orientation | Disarray, neovascularization necrosis, increased myofibroblasts |
| Appearance | Shiny, white, and firm | Dull, gray and soft |
| Structure | Parallel, wavy, tight arrangement | Irregular crimping, loosening, increased waviness, fiber splitting, irregular diameter |
| Healing | Neutrophils, macrophages, lymphocytes | Angiofibroblastic hyperplasia, abnormal immature vessels, fibrotic lumen |

## Eccentrics

- In shortening, the faster a muscle contracts, the smaller the tension it can exert Hill, *Proc Roy Soc B* 1938
- Tension is considerably greater in muscle fibers when lengthened than when shortened Katz 1939, Abbott et al 1951
- During negative work, the O2 consumption rarely rose to more than twice the resting value Katz 1939, Hill 1938, Wilkie 1950

## Eccentrics

- Wilkie, *J Physiol*, 1968; Curtin and Davies 1970
  - When a muscle is stretched, the energy requirement, both heat production and rate of ATP breakdown falls substantially
- Abbott BC et al., *J Physiol* 1952
  - Two subjects performed negative work bicycle ergometry and measured O2 uptake
  - Positive work (con) always resulted in more O2 consumption

## Eccentrics

- Wasielewski et al., *J Ath Train* 2007
- Norregaard et al., *Scand J Med Sci Sports* 2007
- Shalabi et al, *AJSM* 2004
- Jonsson and Alfredson, *Br J Sports Med* 2005
- Alfredson et al, *AJSM* 1998
- Young et al, *Br J Sports Med* 2005

## "Alfredson Protocol" AJSM 1998

- 3x15 3x/day
- 12 weeks
- 1-2 exercises
- Load increases in 5kg increments using a backpack

## Elbow Tendinopathy

- MWM is strongly recommended to decrease pain and increase grip strength with chronic lateral epicondylitis (osis??)
- Long term effects are unknown

Pagorek, J Sport Rehab, 2009; 18: 448-457.

## Exercise Progression: McTherapy

- 3x15 for everything
  - Strength? Hypertrophy? Endurance?
- 3x15 each treatment at each phase of therapy
  - Where are they on the timeline?
- Random progression
- Too much, too soon
- Not having objective measures prior to progressing
  - How can we let them run if they can't perform a single leg heel raise or single leg squat?

## Modalities

- Grossly overused, misused and abused
- Ultrasound
  - Intensity? Frequency? Thermal vs. Non-thermal?
- Ionto
  - How long? What intensity?
- Hot/Cold
  - Which method to use?
- Alternative modalities – worth a d@*n?
  - Laser, Diathermy

## Ultrasound

- Little evidence on biophysical effects or effectiveness in treating pain Robertson and Baker Phys Ther 2001; Baker and Robertson Phys Ther 2001
- Evidence is mounting that 3 MHz may actually be better at heating tissues >3 cm deep Gallo et al, JOSPT 2004; Hayes et al, J Ath Train 2004

## Mechanism of Ultrasound Starkey

- Cavitation
  - Waves cause vibration of gas bubbles
- Microstreaming
  - Cavitation leads to flow of fluids surrounding tissue
  - Changes cell membrane structure and function and facilitating passage of ions in/out of cell

## Ultrasound

- Beam Non-Uniformity Ratio (BNR)
  - Hottest portion of wave divided by average
  - Higher BNR, greater risk for "hot spots"
  - Use lowest BNR possible
- Effective Radiating Area (ERA)
  - Size of sound head
  - NO MORE THAN 2x THE SIZE OF THE HEAD! Gallo et al, JOSPT 2004; Scifers Adv Dir Rehabil 2004; Draper Ath Ther Today 1998
  - Move 2-4cm/second Draper Ath Ther Today 2004

## Ultrasound Starkey

- Thermal Effects
  - Increased sensory and motor NCV
  - Decreased spasm and pain
  - Increased blood flow
  - Increased extensibility of collagenous tissues
- Non-thermal Effects
  - Increased cellular and vascular permeability
  - Increased protein synthesis

## Law of Grotthus-Draper Draper J Ath Train 1993

- Ultrasound ***penetrates*** tissue high in water content
- ***Absorbed*** in tissues high in protein
- ***Reflects*** off bone
- ***Refracts*** through joints

## Conclusions on Ultrasound

- Evidence is mounting for pulsed US for ligament and bone healing
- At least 6 minutes of continuous ultrasound is needed for any appreciable temperature increase
- Coupling medium should be water based, as opposed to cream or gel-based
  - Maybe why studies on phono have been questionable!

## Phonophoresis

- Most common parameters in range of 1-3MHz and intensity of 1-2 W/cm$^2$
- Need gel-based not cream-based meds Cagnie et al Phys Ther 2003
- Pulsed may be better because movement of the head causes more dispersion of medication? Mitragotri et al, J Pharm Sci 1995; Cagnie et al, Phys Ther 2003
- Heating increases kinetic energy of drug molecules and cell membrane as well as dilating points of entry? Byl et al, Phys Ther 1995

## Cold Modalities Bleakley et al, AJSM 2004

- No differences between ice and ice/estim for swelling, pain, and ROM
- Continuous cryotherapy more effective than intermittent icing after surgery
- Ice and compression no more effective than ice alone for acute ankle injury
- Ice and compression better for analgesia compared to ice
- Very effective when combined with exercise

## Cold Modalities

- Ice water immersion or wetted ice most effective for temperature reduction
- Blood flow is best during cryokinetics

## Low Level Laser Therapy

- Cleared by FDA for relief of wrist and hand pain due to CTS and for relief of minor chronic neck and shoulder pain McLeod AT Today 2004
- Approved for superficial wound healing Hopkins et al, J Ath Train 2004
- Acute injuries respond best w/ lower dosages daily, while chronic should be treated w/ higher doses every 2-3 days McLeod AT Today 2004

## Laser Therapy

- Evidence is very conflicting, but there is some support for relief of pain in OA and RA as well as in focal, superficial areas

## Iontophoresis

- Tissue resistance is directly proportional to intensity of current
  - Why the 24-hour patches are used
- Time, not current magnitude dictates depth of penetration Anderson et al, Phys Ther 2003
- Low current more efficient in physiologic effect Anderson et al, Phys Ther 2003
- Penetration is deeper when cutaneous capillary beds are restricted Anderson
  - Why we need lower current

## Iontophoresis

- Skinfold thickness did not alter penetration of dexamethasone Gurney et al, JOSPT 2008
- Remember, it's not just dex!
  - Acetic Acid is good for heel spurs and calcific tendinitis
  - Can also use aspirin and iodine
  - Saline for scars???

## E-Stim: Basics Dolan and Mendel AT Today 2004

- DC = Galvanic current
  - Used for denervated muscles, ionto, wound healing
- AC = Faradic current
- PC (Pulsed current)
  - On/off for specific periods
  - Russian stim, interferential, and biphasic are all PC

## E-Stim for Pain

- High frequency = Gate control theory
  - Intensity to tolerance
- Low frequency = endogenous opiates
  - Longer relief, intensity to muscle contraction

## Interferential Current (IFC)

- Widely used, little evidence
- Claimed advantage is its capacity to diminish impedance offered by the skin Low and Reed, 2000
- Amplitude-modulated current proposed to go deeper in treatment area
- Recent review said as a supplement to other interventions, it may help decrease pain at discharge and at 3 months Fuentes et al, Phys Ther 2010

## E-Stim: TENS

- Minimal to no evidence that TENS is helpful for pain reduction in acute or chronic neck/back pain or OA
  - Dubinsky and Miyasaki, Neurology 2010; Kroeling et al Cochrane Database Syst Rev 2009; Rutjes et al, Cochrane Database Syst Rev 2009; Walsh et al, Cochrane Database Syst Rev 2009

## E-Stim: NMES

- Good evidence supporting NMES for quad function post-knee surgery Min Kim et al, JOSPT 2010
- Longer pulse duration the better Gorgey et al, JOSPT 2008
- Decreased frequency (100-25 Hz) decreases fatigue Gorgey et al
- Lower metabolic effect of lower frequencies Gorgey et al
- 10-20% duty cycle maximizes torque and patient comfort Ward et al, Med Eng Phys 2004

## Key Point…

- No evidence exists that NMES actually ***improves*** function but it ***DOES*** alter compensatory strategies which delays function Min Kim et al, JOSPT 2010

## E-Stim: Edema and Wound Care

**Dolan and Mendel AT Today 2004**

- Edema
  - HVPC, ***Negative*** polarity, 120 pps, 90% of visible motor threshold
- Wound care
  - HVPC, ***+ polarity to attract macrophages/ - polarity to attract fibroblasts***, 100 pps, intensity to "tingle" sensation

## H-Wave Therapy

- E-stim device used to decrease pain and inflammation
- Facilitates angioneogenesis and reduction in NO Blum et al Phys Sports Med 2008
- Helps reduce protein buildup Blum et al BMC Musculoskeletal Disord 2009
  - Interstitial fluid shifts at low frequencies (1-2 Hz) by direct stimulation of small-diameter smooth muscle fibers of the lymphatic system
  - Provides pain relief at higher frequencies
  - Improved blood flow and microcirculation

## H-Wave Therapy

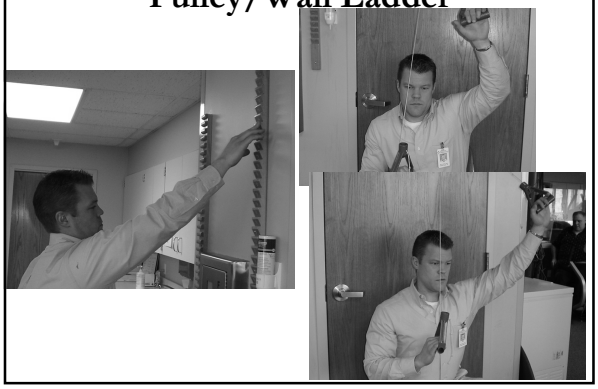
- Meta-analysis indicates its useful for chronic pain Blum et al, Adv Ther 2008
- Evidence is mounting that it is effective for reduction in acute pain, inflammation and swelling
  - Blum et al, BMC Musculoskelet Disord 2008
  - Blum et al, Phys Sports Med 2008

## Diathermy Goats BJSM 1989; Peres et al J Ath Train 2002; Seiger JOSPT 2006

- Not as antiquated as you might think!
- Good evidence supporting it for those who need deep heat over large areas for ***chronic pain***
- Good evidence for those who have extensive scar tissue after surgical procedures
- ***Conflicting evidence over metal – contact manufacturer of device***

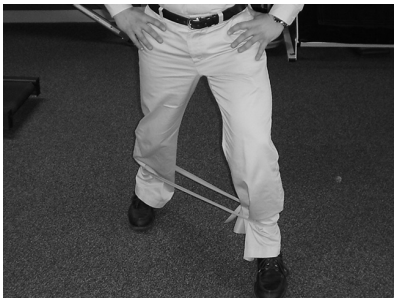
# THE TOP 5 WORST REHAB EXERCISES

## Pulley/Wall Ladder



## "Straight" Leg Raise

## "Monster Walks"



## Scaption w/ a shrug

## Seated Knee Extensions

## The Best…

- Anything working gluteus medius
- Anything working gluteus maximus
- Anything working posterior rotator cuff and scapular stabilizers
- TA Hallowing w/ diaphragmatic breathing
- Sit to stand/squat patterns

## THANK YOU!!!

**c Therapy**

I'm ***HATIN*** it!