CHRONIC MUSCULOSKELETAL INJURIES UPDATE

Chairperson: Dr. Manijeh Berenji

Monday, April 30th

2:15-2:55pm

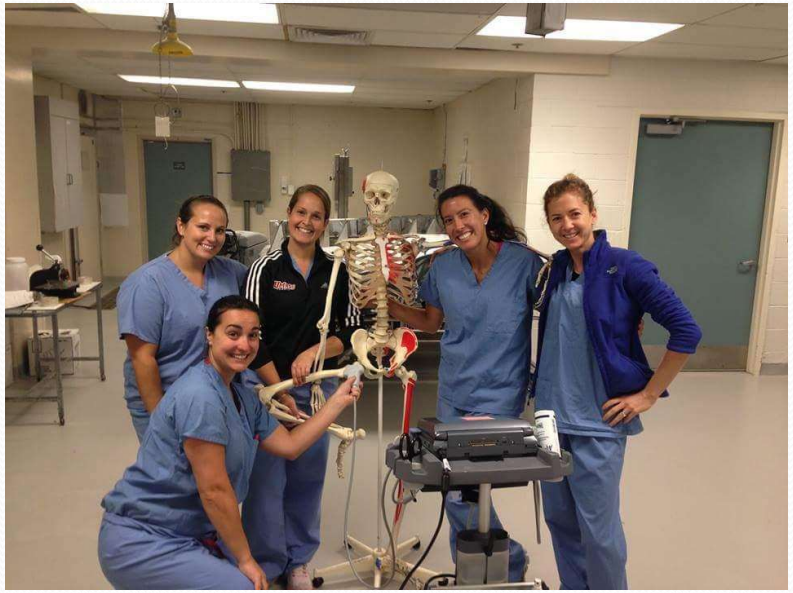
Introduction to Regenerative Medicine for the Occupational Healthcare Provider

Jennifer Luz, MD, RMSK

Work Related Injuries Workshop
April 30th & May 1st, 2018

Introduction

- To speak intelligently with patients that google…



Patients that google

Goals and Objectives

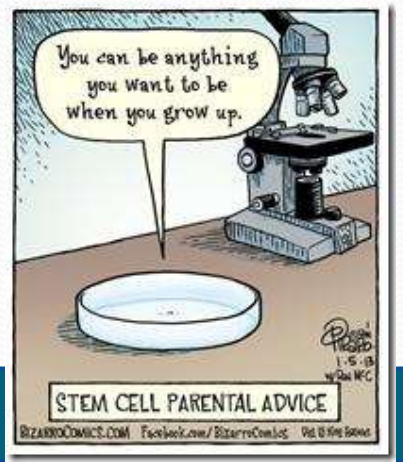
- Goal: To introduce learners in the occupational healthcare field to regenerative medicine
- Objectives

1. Discuss the general definition of regenerative medicine so to explain to patients what it is
2. Identify and brainstorm potential uses of regenerative medicine in an occupational injured patient

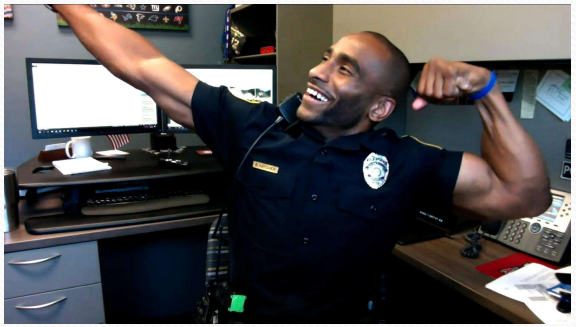
What is Regenerative Medicine

- Potential to heal damaged tissue and organs

1. Support or augment the body's natural ability to heal itself
2. Replace damaged cells with healthy ones
3. Regenerate damaged tissue



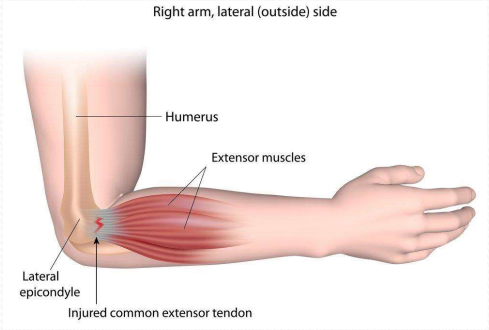
Our patient



- Lateral elbow pain for 2 years
- Use of force injury
- Surgical debridement at the lateral epicondyle 1 year ago, modest improvement in pain
- 6 cortisone injections, immobilization, bracing, physical/occupational therpay but worsening pain
- SWAT team member
- Pain at the shooting range, steering police cruiser, lifting heavy weights

Potential treatment

- Lateral and medial epicondylitis
- Rotator cuff tendinopathy
- Hamstring tendinopathy
- Patellar tendinopathy
- Achilles tendinopathy
- Plantar fasciitis
- Knee osteoarthrits



Potential Treatment

- "Cartilage stem cells identified, but can they heal?"
- Andrei S. Chagin and Ekaterina V. Medvedeva

Regeneration of articular cartilage has been a long-standing challenge in the field of regenerative medicine. In the past 2 years, several studies have genetically identified the presence of stem cells in the surface of articular cartilage, but questions remain as to the healing properties of these cells.

Decker et al. Dev. Biol. 2017

Adult Learning Theory!

- "Tell me and I forget, teach me and I remember, involve me and I learn"

- Benjamin Franklin

Question 1

What is the general defenition of regenerative medicine?

a. Both a clinical and research area of medicine which seeks to harness the potential for self-healing damaged tissues and organs
b. A branch of medicine which researches tissue organ transplantation
c. The study of tissue engineering via stem cell therapies
d. The treatment of injury via enhancement of natural self-healing in the body

Question 2

A 52yo female is injured at work by slipping and falling on ice 1 year ago. She has chronic knee pain and although she continues working, she has difficulty with stairs, squatting and prolonged sitting or standing. MRI is consistent with chondromalacia patella, mild tri-compartmental OA and degenerative meniscal injury. What are potential treatment options?

Question 2

a. Physical therapy for patellofemoral pain, eccentric quadricep and gluteus medius strengthening, hamstring and ITB stretching, proprioception, HEP
b. Cortisone injection to intra-articular knee
c. Arthrosocopic synovectomy, debridement, meniscectomy
d. Platelet rich plasma injection
e. Knee support bracing
f. Stem cell treatment
g. All of the above

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Questions

- Jennifer.luz@steward.org

The "Jammed Finger" PIP Joint injuries - Pearls & Pitfalls"

Andrew B. Stein, MD
Boston University Medical Center

Work Related Injuries Workshop
April 30th & May 1st, 2018

Disclosures/COI

- None

PIP Joint is *the* Most Unforgiving Joint in Hand

- Motion Critical for normal finger function
  - Largest motion arc of any IP joint
  - Accounts for 85% excursion at fingertip
- Long lever arm/exposed position make it vulnerable
  - Most commonly injured joint in hand

PIP Joint

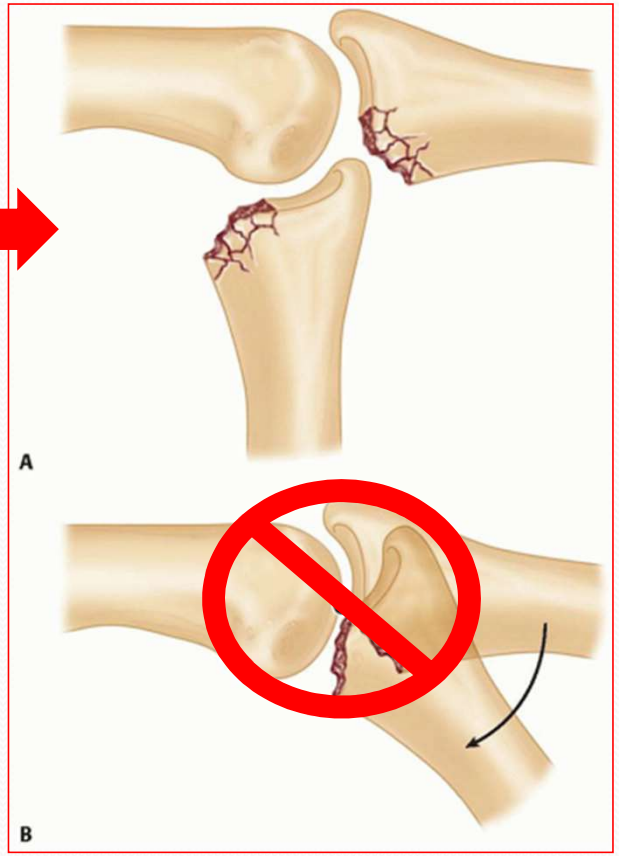
- PIP prone to stiffness
- Injuries often overlooked/dismissed (Just a "jammed" finger)
  - Self treatment often leads to late presentation
  - Early diagnosis & treatment lead to better outcomes

Why Treat?

- Inappropriate Management:
  - persistent pain
  - loss of motion
  - functional impairment
  - traumatic OA
- Little high level evidence to guide treatment

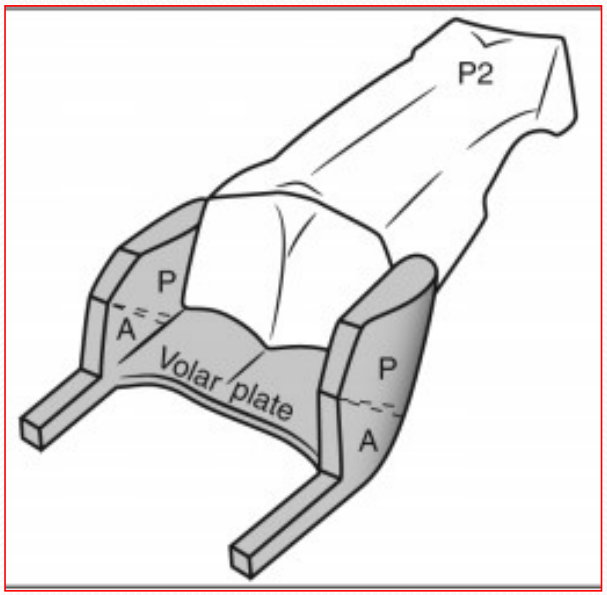
Goals of Treatment

- Restore Joint Congruence/Glide
  - anatomic reduction not crucial
- Early Motion



Anatomy

- Hinge Joint (incongruous but articulating surfaces)
  - Slight asymmetry – P2 supinates in flexion
- ROM: 0-110°
- Ligamentous "Box"
  - Disruption of 2 "sides" results in instability

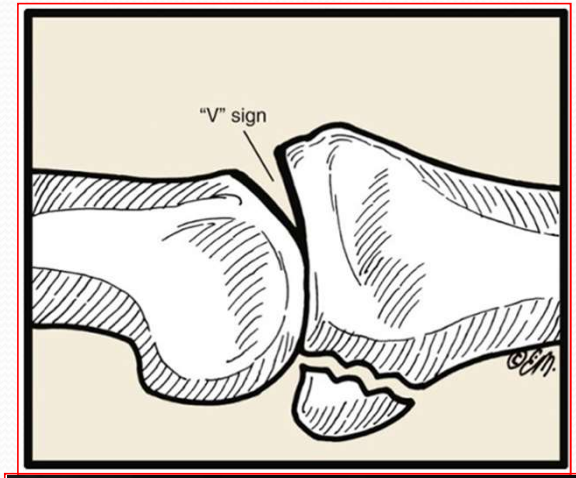


Imaging

- Plain films usually suffice
  - *Finger* Films (*Hand* films unacceptable)
- Stress/traction views
- CT

Insist on *Finger* Films

- Injuries may be missed with *hand* x-rays
- "V" sign is indicative of joint incongruity
  - May be subtle



Hand vs.Finger Films

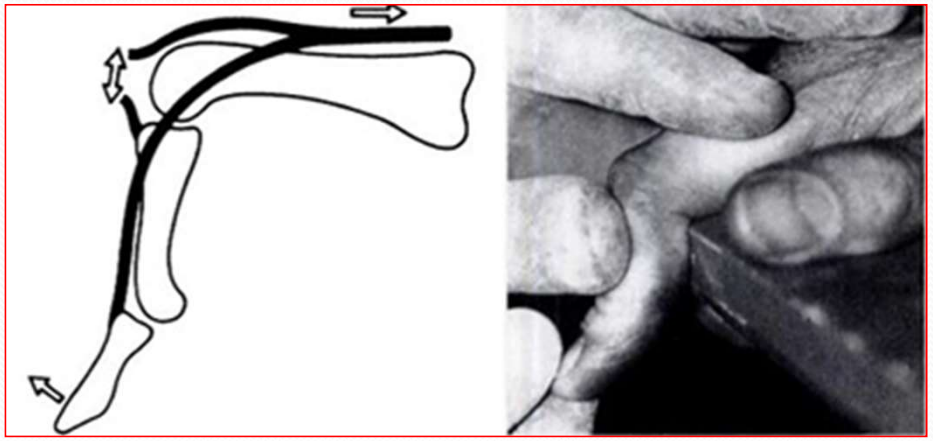
Sprains

- Typically *overtreated* (by PCP or ED) w/splint
  - Instability uncommon (swan neck deformity 2° volar plate disruption)
- Stiffness ("pseodo-boutonniere") more likely

Sprains

"Pseodo-boutonniere" (i.e. flexion contracture of PIP) vs. True boutonniere

-Distinguish with Elson's Test (DIP hyperextension is seen if central slip disrupted)



Sprains

- Avoid splints!
- Start ROM ASAP
  - Buddy-tape
- Typically 3-4 months for pain to resolve
- 1 year for appearance to improve (patient education helpful)

Dislocations

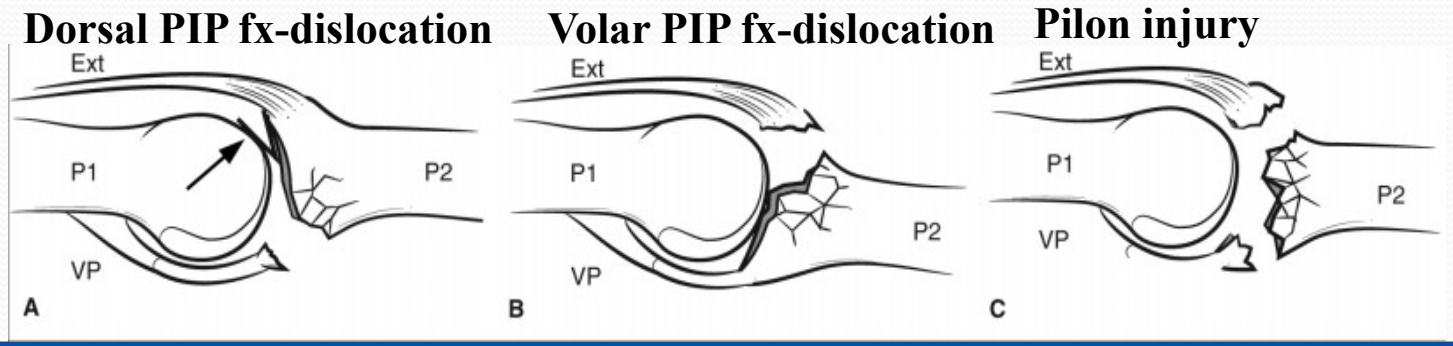
- Dorsal (common)
  - Hyper-extension +/- axial load
  - Often open
  - rarely irreducible
  - Treat like sprain
    - Early ROM
    - Immobilize 1 week at most

Dislocations

- Volar (uncommon)
  - Palmar directed force
  - Central Slip Injury
  - Reduces easily
  - Splint/pin PIP in extension 4 wks -2 wks dynamic splint

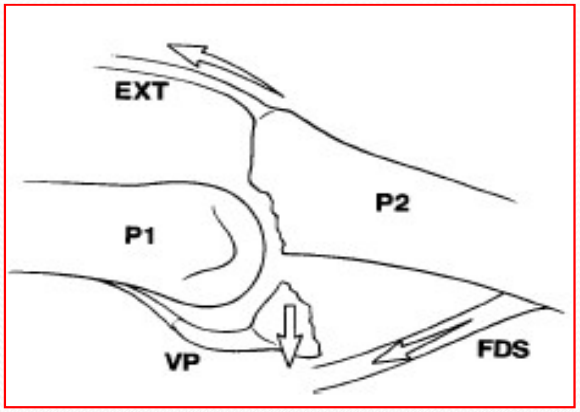
Fracture-Dislocations

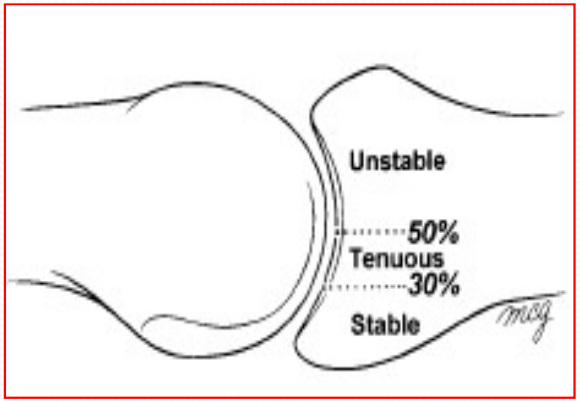
- Proximal Phalanx (rare)
- Middle Phalanx (common) – 3 Patterns
  - Volar lip
  - Dorsal lip
  - Pilon (defined as involvement of volar & dorsal lips)



Volar Lip Fractures

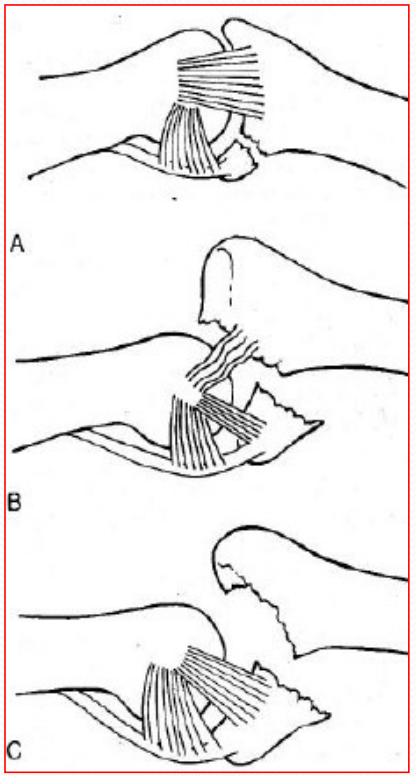
- Stable
  - <30% base
- Tenuous
  - 30-50% base
- Unstable
  - >50% base
  - Need >30° flex to maintain reduction





Dorsal Fracture-Dislocation

- Stable or not? (depends on collateral ligament attachments)
  - Exam
    - Digital block often necessary to assess ROM and joint stability
  - Xray
    - If hinging suspected get flexion/extension views (may appear as normal ROM)



Fracture Dislocation

- Treatment Options
  - Immobilization
  - Protected motion
  - Traction/Ext. Fixation
  - ORIF
  - Buttress reconstruction

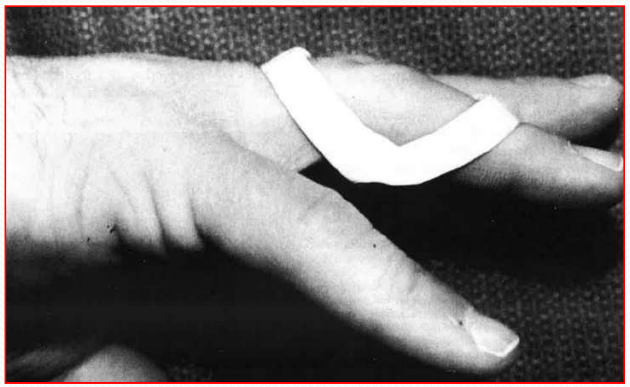
PIP Fracture-Dislocation

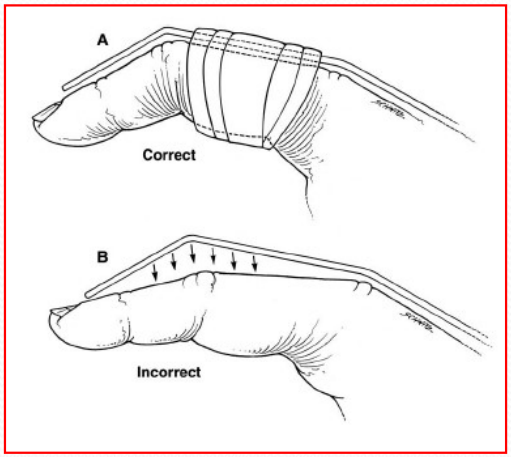
- Immobilization
  - Splinting
  - K-wire fixation of PIP joint
  - Results
    - Worse outcomes with immobilization than early motion in cohort of pts w/stable injuries (no radiographic evidence of subluxation)

Phair et al J *Hand Surg Br* 1989

PIP Fracture-Dislocation

- Protected motion
  - Buddy taping
    - Stable in extension
    - Protects from hyperextension
  - Figure-of-8 splint
    - Stable in mild flexion
  - Extension block splinting
    - Stable in up to 30^0-40^0 flexion
    - Forearm, hand, digit based

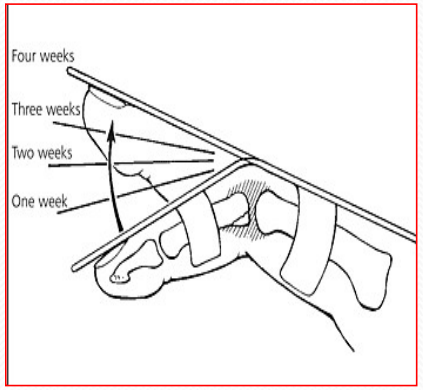




Protected Motion

Dorsal block splint

- 30° flexion
- full time splint x 2 wks
- increase extension ~10°/ wk
- Need Compliant patient (& MD!)
  - Careful f/u xrays

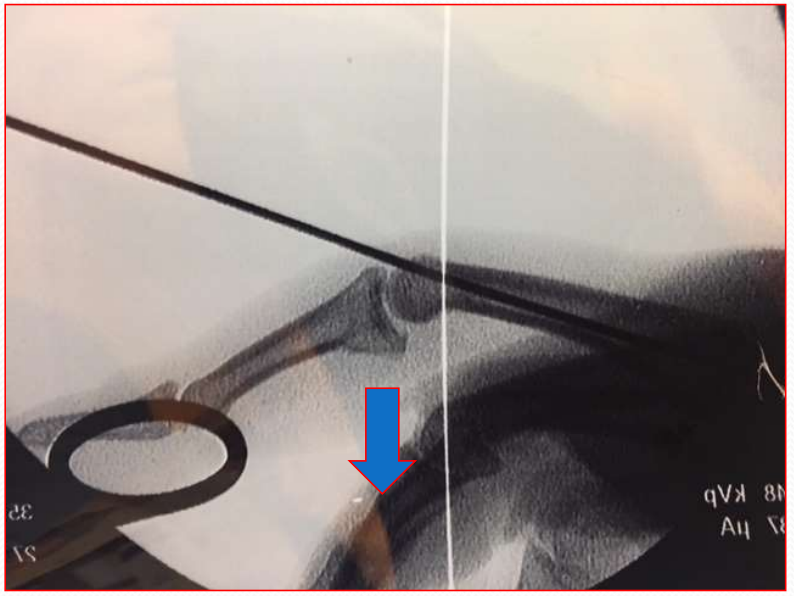


Extension Block Pinning

- First described by Viegas *JHS* 1992 (3 pts)
  - K wire buttress against middle phalanx subluxation
  - Allow AROM

26M fell skateboarding

Single 0.045 K-wire



Extension Block Pinning

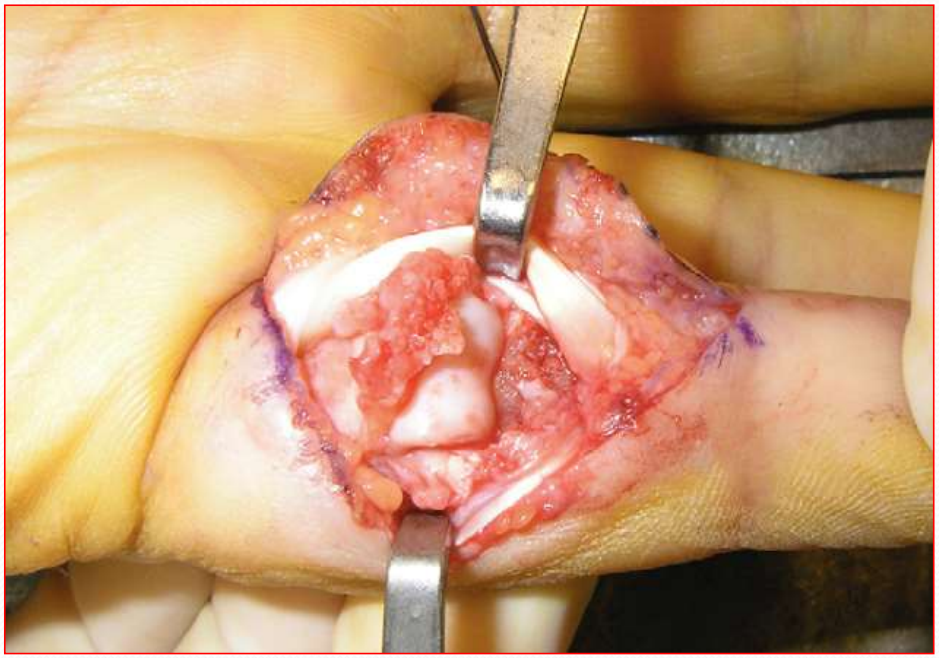
- Simple technique
  - Local anesthetic
  - Reduction achieved with PIP flexion
  - Reduction maintained until pin removal
  - Motion usually not tolerated (pt dependent)
- Remove pin at 3-4 wks.

ORIF

- Large fragments & minimal comminution
  - K-wires
  - Tension banding
  - Cerclage wires
  - Screws
  - Pull out sutures
- Need stable fixation
  - Volar approach

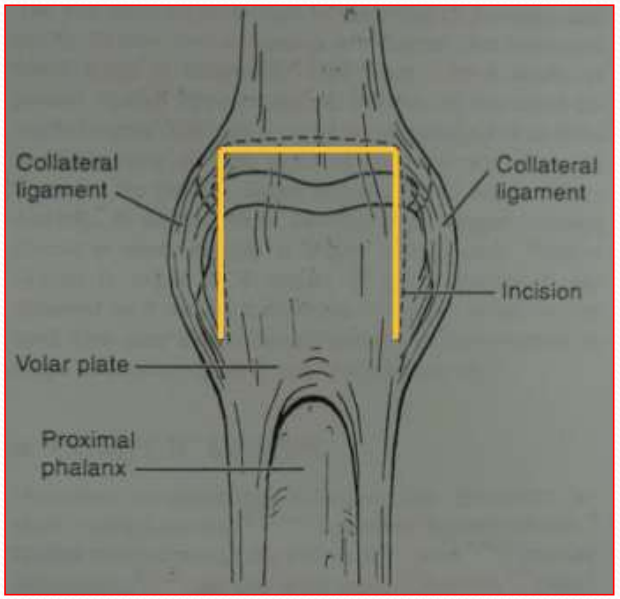
ORIF w/Screws

ORIF



- Volar approach between A2 & A4 pulleys

ORIF



- Release volar plate distally & shotgun joint open
- Elevate joint & fix with wire/screws

ORIF?

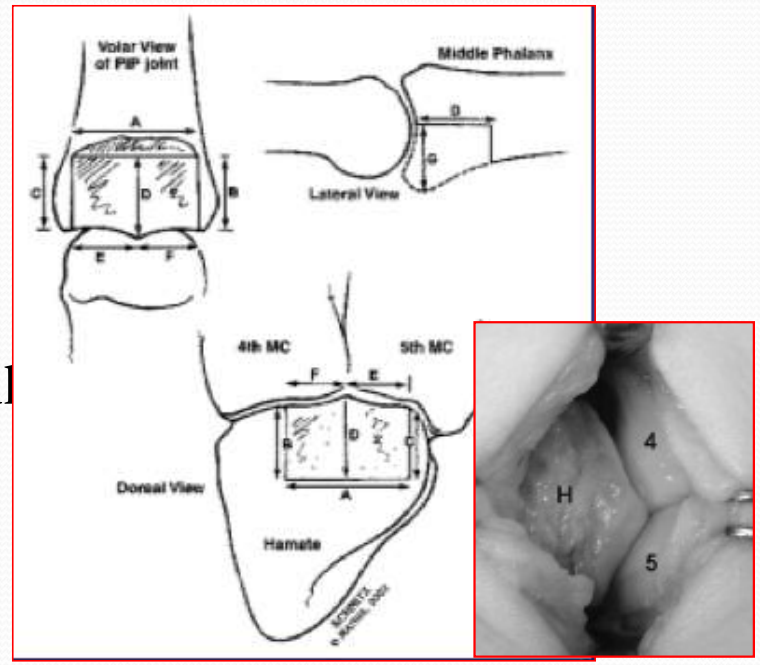
- Advantages
  - Early AROM
  - No trans-articular fixation/ex fix
- Disadvantages
  - Technically challenging
  - Additional soft tissue dissection

Buttress Reconstruction

- Volar plate Arthroplasty
- Hemi-Hamate Grafting
  - Generally reserved for late presenting injuries or P2 involvement > 50%

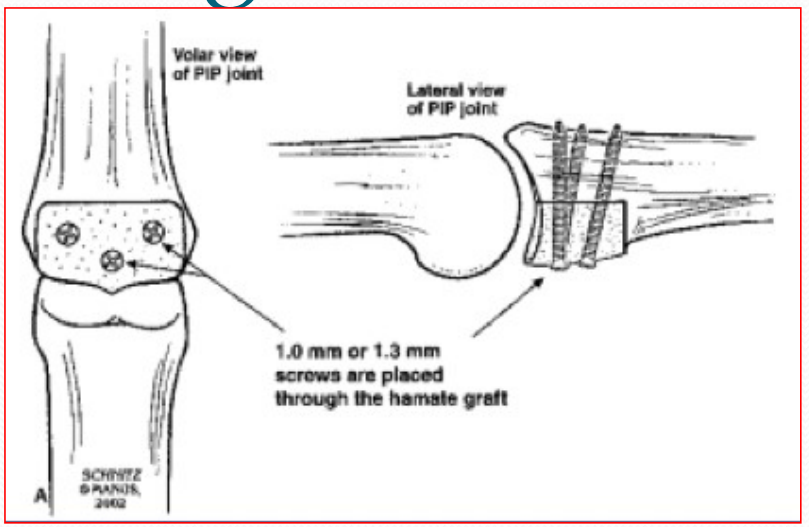
Hemi Hamate Reconstruction Arthroplasty

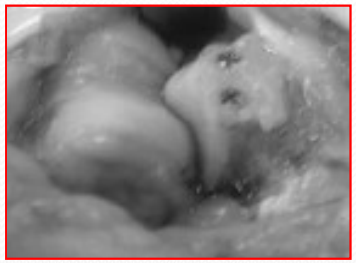
- Bony Buttress Reconstruction
  - 1st described by Hastings 1999 ASSH Mtg
  - Articular surface contours similar at base P2 and dorsal hamate at 4/5th CMCJ



Hemi Hamate Grafting

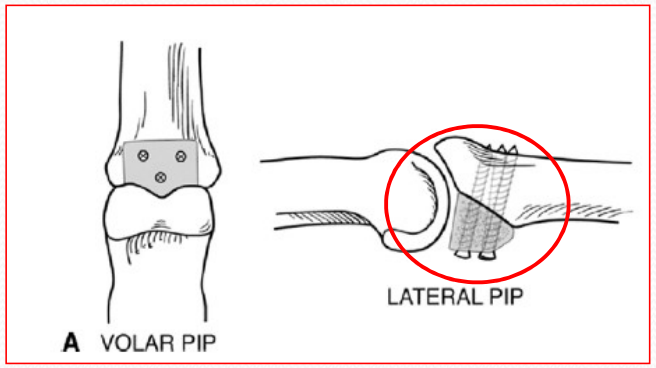
- Volar shotgun approach
- Autograft width/depth determined by size of defect
- Fix with 2-3 screws





Hemi Hamate Grafting

- Pearls
  - Cant graft to reconfigure P2 palmar buttress (cut defect to be more shallow distally)

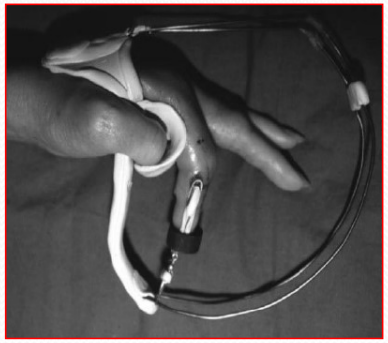


28M presents 3 mo s/p injury

Hemi-Hamate Graft

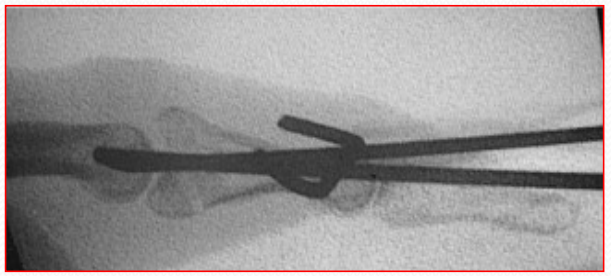
Dynamic Distraction & External Fixation

- Traction
  - Many types described
  - All w/longitudinal traction
    - Some w/volarly directed reduction force
  - Off-loads joint
  - Allows early motion
  - Promotes joint remodeling
  - Minimal soft tissue damage



Dynamic Distraction & External Fixation

- Consider for Pilon Injuries (& unstable fracture-dislocation)
  - Disruption of both dorsal & volar lips of middle phalanx
  - Principles of ligamentotaxis



Post-Traumatic Arthritis

- Salvage options
  - Fusion
    - One and done
  - Arthroplasty
    - **Silicone** interposition arthroplasty (constrained)
    - Surface replacement arthroplasty (unconstrained)
      - Metal on poly
      - Pyrocarbon
  - Amputation

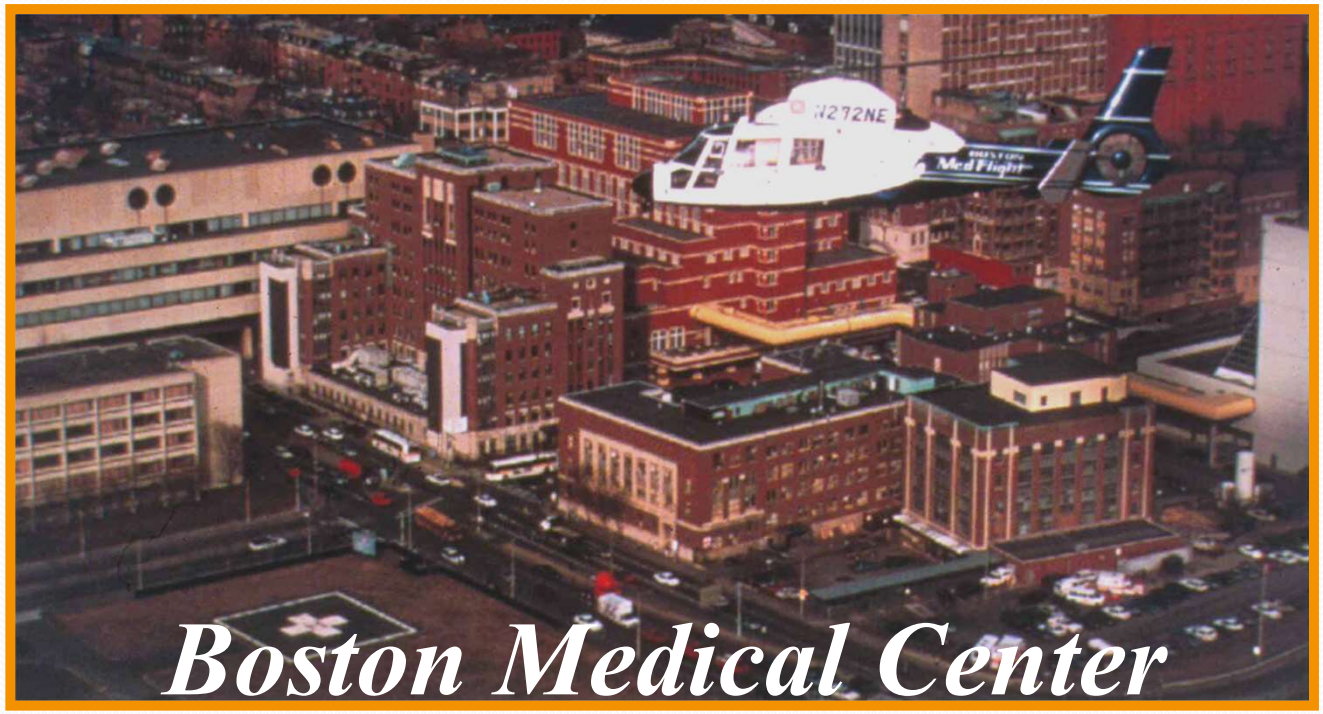
Arthroplasty

- Consider in patient with desire to maintain motion (unwilling to fuse)
- Adequate soft tissue envelope
- Lower demand individual

Summary

- PIP injuries encompass a spectrum of injury severity
  - Minimal intervention to advanced reconstructive surgery
- Goal is to confirm or re-establish articular gliding
  - Use the technique that works best for a given injury in your hands
- Early active motion!

THANK YOU!



Customized Stretching Programs Implemented with Ergonomic Recommendations

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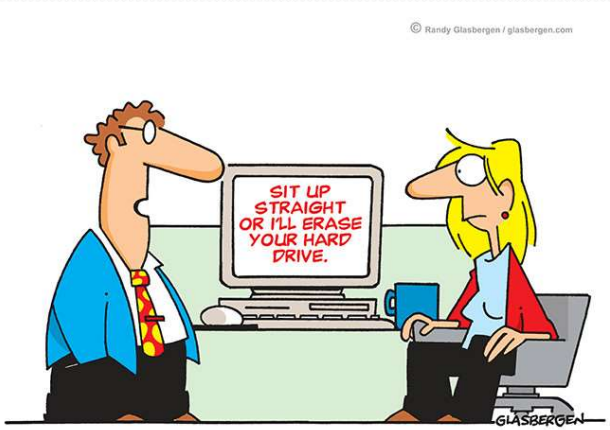
Work Related Injuries Workshop
April 30th & May 1st, 2018

Michelle has been practicing as an occupational therapist (OT) for 16 years specializing in upper extremity injures, work related injuries, and ergonomics. Michelle began her ergonomics career at Harvard University as a Disability Case Manager focusing on office, laboratory, manual materials handling ergonomics and return to work programs. She has worked as an outpatient hand therapist and ergonomics specialist for a Cambridge based hospital system and for one of the world's oldest leading global biotechnology companies, in Cambridge, MA, providing overall management for their ergonomics program. Currently, Michelle works as an Ergonomic Specialist for Partners Healthcare, the largest private employee in Massachusetts. Michelle's goal as an ergonomics specialist is to improve employee health, safety, and comfort, as well as to increase productivity for management and cost savings to the company. Michelle was educated at Salem State University, where she received her Master of Science in Occupational Therapy and further education in Ergonomics & Human Factors from Harvard School of Public Health. She is also certified as an ergonomic assessment specialist (CEAS II) through the Back School of Atlanta.

Ergonomics



"It's called Ergonomics."

The International Ergonomics Association defines ergonomics or human factors as follows:

Ergonomics (or human factors is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design to optimize human well-being and overall system performance.

U.S. Department of Labor, OSHA 3125; Ergonomics: The Study of Work

- It is the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job.
- Adapting tasks, work stations, tools, and equipment to fit the worker can help reduce physical stress on a worker's body and eliminate many potentially serious, disabling work-related musculoskeletal disorders (WMSDs).

United States OSHA Occupational Safety & Health Administration U.S. Department of Labor

The goal of a workplace ergonomics program:

- To eliminate or reduce a workers exposure to risk factors/hazards that may cause Work-Related Musculoskeletal Disorders (WMSDs) (CDC)

According to the CDC, WMSDs are conditions in which:

1. The work environment and performance of work contribute significantly to "the condition"; and/or
2. "The condition" is made worse or persists longer due to work conditions

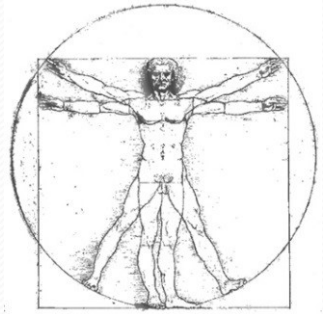
"The condition" being Musculoskeletal Disorders (MSDs):

- MSDs are injuries affecting the connective tissues of the body such as muscles, nerves, cartilage, tendons, ligaments and joints (OSHA), and can include spinal discs (CDC).

  Examples: Sprains, Strains, and Tears; Tendinitis, Carpal Tunnel Syndrome and low back pain.

  Not injuries from slips, trips, falls (CDC and OSHA)

  According to the Bureau of Labor Statistics (2016), musculoskeletal disorder cases account for one-third of all worker injury and illness cases.



Ergonomic risk factors/hazards in the workplace that can cause or aggravate MSDs include:

- Repetitive motion
- Forceful exertions
- Compression or contact stress
- Static postures
- Vibration and
- Awkward posture (non-neutral postures)
- Cold temperatures (OSHA, 2000)

Prolonged exposure to ergonomic risk factors can cause damage to a worker's body and lead to MSDs.

Non-Work-Related Risk Factors:

- Gender
- Age
- Fitness Level
- Medical conditions: obesity, diabetes, arthritis
- Out of work activities: hobbies, sports
- Psychological or social workplace stress

(OSHA, 2000)

Methods used to eliminate or reduce ergonomic risk factors: (CDC, 2016)

(1) Engineering Controls, The preferred approach to prevent and control WMSDs is to design the job to take account of the capabilities and limitations of the workforce. Some examples include:

- Changing the way materials, parts, and products can be transported. For example, using mechanical assist devices to relieve heavy load lifting and carrying tasks.
- Changing workstation layout, which might include using height-adjustable workbenches or locating tools and materials within short reaching distances.

(2) **Administrative Controls** are policies and practices that reduce WMSD risk but they do not eliminate workplace hazards. Although engineering controls are preferred, administrative controls can be helpful as temporary measures until engineering controls can be implemented or when engineering controls are not technically feasible. Some examples include:

- Reducing shift length or limiting the amount of overtime
- Changes in job rules and procedures such as scheduling more breaks to allow for rest and recovery
- Rotating workers through jobs that are physically tiring
- Training in the recognition of risk factors for WMSDs and instructions in work practices and techniques that can ease the task demands or burden (e.g., stress and strain)

(3) Use of Personal Protective Equipment (PPE)

PPE generally provides a barrier between the worker and hazard source. Respirators, ear plugs, safety goggles, chemical aprons, safety shoes, and hard hats are all examples of PPE

Drennan et al 2006 (cited in Choi and Woletz 2010) Another method that may be used to reduce the occurrence of WMSDs and injuries is stretching and flexibility exercise programs.

A Workplace Ergonomics Program: Is A Complete Prevention Strategy

As pointed out by OSHA (1993), implementing a comprehensive ergonomic program that includes both engineering and administrative controls to reduce the ergonomic risk factors should be the first choice in reducing WMSDs.

There are mixed reviews on whether stretching is part of that ergonomics process.

Stretching:

Defined by movement applied by an external and/or internal force in order to increase muscle flexibility and/or joint range of motion (Weerapong et al. 2004).

Types of Stretching:

1. Static: a specific position is held with the muscle on tension to a point of a stretching sensation and repeated.
2. Dynamic: moving a limb through its full range of motion to the end ranges and repeating several times.
3. Pre-Contraction: involves a contraction of the muscle being stretched or its antagonist before stretching.

(Page, 2012)

- The benefits of stretching seem to be individual to the population studied. (Page 2012)
- To increase ROM, all types of stretching are effective, although pre-contraction-type stretching may be more effective for immediate gains. (Page 2012)
- To avoid decrease in strength and performance that may occur in athletes due to static stretching before competition or activity, dynamic stretching is recommended for warm-up. (Page 2012)
- If inadequately performed, stretches may also cause or aggravate injuries (Costa and Vieira, 2008).

What the Research Says:

Moore 1998 (cited in Choi and Woletz 2010) a pharmaceutical manufacturing facility examined the effect of a workplace stretching program.

- 36 stretching sessions over a 2-month period (5 times a day between 5-8 minutes), involving 60 employees.
- Stretching exercises involved the neck, shoulder, arm, trunk, hip, back and legs.
- Participants reported an increase in flexibility and an increase in physical self perceptions (i.e. body attractiveness, physical conditioning and overall self worth).
- During the program there were no reported WMSDs
- Stretching programs may benefit employees by increasing flexibility and potentially preventing WMSDs,
- A limitation of this study was that there was a limited description of stretching protocols and included no control groups.

Hilyer et al. 1990 (cited in Choi and Woletz A study of 469 municipal firefighters evaluated the effectiveness of a flexibility program on work related injuries. Researches examined the incidence, cost and severity of joint injuries between groups of firefighters that stretched and groups that did not stretch.

- The program consisted of 12 different exercises done in one daily 30-minute session during a 6 month period.
- 2 Groups: 1. participated in the stretching program; 2. didn't participate.
- Those who participated in the stretching program were more flexible than those who did not.
- Over the course of two years, the group of firefighters that participated in stretching incurred 48 injuries and the non-stretching group experienced 52 injuries. Injury types were not described
- The cost of the injuries was significantly different; total cost of injuries (medical and indemnity) for the group that stretched was $85,371, and for the non-stretchers it was $235,131.
- This suggests that injuries sustained by those who participated in the program were less expensive than injuries sustained by non-stretchers.

Holmstrom and Ahlborg (2005), evaluated the effects on muscle stretchability, joint flexibility, muscle strength and endurance in construction workers of a 3-month period of a 10-min. morning warming-up exercise.

- 47 male construction workers
- Composed by a physiotherapist to include different arm-swings combined with knee-bendings, shoulder lifts, leg kicks, spinal movements, transfer of body weight from side to side and jogging mark time. Ended with stretching, particularly of the hamstring, quadriceps, and calf muscles.
- Hamstring and thigh muscle stretchability as well as thoracic and lower back flexion mobility increased.
- A significant difference in back muscle endurance but muscular strength was not affected.
- The authors suggested that a short dose of morning warming-up could be beneficial for increasing or maintaining joint and muscle flexibility and back muscle endurance for workers exposed to manual material handling and strenuous working positions.

Jepsen and Thomsen (2008), examined the effects of stretching on the prevention of upper limb disorders in the right arm among computer operators.

- a controlled study of 184 computer operators that spend at least 20% of their workday at computer workstations.
- To establish baseline, all of the subjects completed a questionnaire and a neurological examination.
- Stretching intervention: a physiotherapist instructing stretching exercises based on neurodynamic principles.
- Four stretches for the right arm were prescribed to different regions; the volar forearm flexors, the pronator muscle, the median nerve and the radial nerve. Lasting 6 consecutive months.
- The control group did not engage in any stretches.
- At conclusion the all participated in a follow up neurological examination and questionnaire, consisting of self-reported pain levels and neurological findings.
- Significant improvement wit regard to the function of the pronator muscle and mechanosensativity for the median nerve were found.
- Conclusion: stretching alone could not be identified as a single method of preventing upper extremity disorders among people who work at computer workstations.

More Research:

- A paper titled, “Do Stretching Programs Prevent Work-Related Musculoskeletal Disorders” (WMSD’s) by Authors Dr. Sang Choi and Todd Woletz (2010) reviewed several research articles and concluded that, “While research does support that stretching improves flexibility/ROM and self-worth, stretching alone might not prevent work-related musculoskeletal disorders and injuries. In order to provide a more beneficial approach to reducing (WMSD's) it is important to consider a comprehensive injury prevention program.
- May 2002 (cited in Choi and Woletz) Companies that have implemented OSHA’s ergonomic guidelines have lower incidence cumulative trauma injuries and associated workers’ compensation costs.

- Scientific evidence does show that effective ergonomic solutions can lower the physical demands of manual material handling work tasks; thereby lowering the incidence and severity of the musculoskeletal injuries they can cause (NIOSH, 2007).
- Amick et al. 2009 (cited in Choi and Woletz 2010) WMSD prevention interventions should focus on the reduction or elimination of the job task-specific ergonomic risk factors. This can be accomplished with a comprehensive ergonomic program which includes a combination of engineering ad administrative controls, training, management and employee support and sufficient resources.

According to McGorry and Courtney 1995 (cited in Kohn 1998), the safety professional who wishes to incorporate exercise into the ergonomic intervention strategy should consider several factors:

1. Before a worksite exercise program is begun, employees should be screened for preexisting medical conditions in order to avoid exposure to exercises that may be contraindicated, therefore, healthcare personnel should be involved in implementation.
2. The exercise program should consider the task motion and/or postures involved. Whenever possible, exercise should address a particular work stress. Passive stretching should be initiated slowly and held for at least five seconds in order to induce desired results on stretch receptors. Prolonged static stretches produce relaxation of skeletal muscles. Rapid or jerking stretches induce activities that stimulate muscle contraction and can produce spasms.
3. Although the literature does not adequately address an exercise period's frequency or duration, generalizations can be made.
4. In certain situations, scheduling is the key. Exercise sessions should not increase task demands by creating backlog. Impact on other muscle groups should also be considered.
5. Selected exercises should not be embarrassing to perform nor disruptive to the workplace.
6. Anyone selecting exercise as an intervention should be aware of the apparent federal regulatory position on upper extremity exercise as applied to Repetitive Stress Injuries (RSIs).

According to Hess and Hecker (2003), based on review of literature and American College of Sports Medicine recommendations developed:

Criteria for an effective workplace stretching program

- Warm-up for 5 minutes prior to stretching
- Exercises should be tailored to commonly performed job duties
- Stretch regularly: 2–3 days/week, minimum
- Perform stretches correctly:
  - Use static or PNF stretches
  - Hold stretch 15–30 seconds
  - 3–4 repetitions per muscle group
  - Stretch bilaterally, emphasize tight muscles
- Intensity should be to a position of mild discomfort
- Trained instructors should lead and monitor classes
- Compliance should be monitored
- Stretch at appropriate work times throughout the day
- Company commitment to work time and program overhead costs

In Conclusion:

- Currently, there is limited scientific evidence in this area that can assist companies in determining if a pre-shift stretching program would be beneficial.
- Stretching must not be used in place of engineering and/or administrative improvements.
- Some say stretching it is part of Administrative Controls and other say it is not because it doesn't meet the definition of ergonomics. Stretching is not a change to the workplace conditions or job demands, but rather a change to the worker.
- The use of stretching may be appropriate as part of a comprehensive ergonomic program.
- Enlist the assistance of a qualified professional in ergonomics.

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