Reducing Upper Extremity Injuries in the Workplace: Prevention, Ergonomics & Treatment Algorithms

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Indiana Hand to Shoulder Center

- Established in 1973 – over 40 years ago
- 11 Hand Surgeons
  - William B. Kleinman, MD
  - James J. Creighton, MD
  - Robert M. Baltera, MD
  - Thomas J. Kaplan, MD
  - Kevin R. Knox, MD
  - Kathryn A. Peck, MD
  - Thomas J. Fischer, MD
  - Alexander D. Mih, MD
  - Jeffrey A. Greenberg, MD
  - Gregory A. Merrell, MD
  - Nicholas E. Crosby, MD
- 17 Therapists [16 OTs, 1 PT]
  - 12 certified hand therapists (CHTs)
- 7 Locations in Central Indiana
Topics

- State of Indiana - Bureau of Labor & Statistics
  - A Few Interesting Facts!
- Medical Management & Therapy Intervention
  - Rotator cuff tendinitis
  - Lateral epicondylitis
  - Cubital tunnel syndrome
  - Carpal tunnel syndrome
  - Trigger finger

Top 10 Employers - Indiana

- Wal-Mart
- U.S. Government
- Indiana University Health
- State of Indiana
- Indiana University
- St. Vincent Health
- Kroger
- Purdue University
- Franciscan Alliances
- Eli Lilly
Top 5 Occupations - Indiana

- Retail Sales
- Food Preparation & Food Servers
- Cashiers
- Team Assemblers
  - Assembling or packaging products
- Laborers & Freight, Stock & Material Movers
- #6 Indiana & #5 USA – Nursing Staff

Indiana Jobs

- Low Physical Demand
  - Sedentary Desk Jobs
    - Computer
    - Cashier
- High Physical Demand
  - Manual labor
Bureau of Labor & Statistics - 2013

Musculoskeletal Disorders → 33% of all Injury/Illness Cases → 22% Upper Extremity
- Shoulder 13%
- Arm (Elbow) 4%
- Wrist 3%
- Hand 2%

Upper Extremity
- Tendinitis – tenosynovitis – nerve compression as opposed to trauma

Musculoskeletal Disorders (MSDs)

Injuries and Disorders of the Soft Tissues
- Muscles
- Ligaments
- Tendons
- Joints
- Cartilage
- Nerves
Musculoskeletal Disorders (MSDs)

- Gradual Onset
- Symptoms [one or more of the following]:
  - Pain
  - Numbness
  - Tingling
  - Joint stiffness
  - Limited or sluggish motion
  - Weakness (longer duration of symptoms)
  - Impaired function

Musculoskeletal Disorders (MSDs)

- Causative Factors
  - Excessive repetitive motion
  - Awkward or static body positioning
  - Inadequate recovery time from activity
  - Mechanical vibration
  - Accelerated motion while bending or twisting
  - Exerting excessive force
  - Cold temperature – work environment
  - Poor ergonomically designed tools/equipment
  - Poor workstation design
Musculoskeletal Disorders (MSDs)

- Other Common Names
  - Cumulative trauma disorders
  - Repetitive trauma
  - Repetitive stress injuries
  - Repetitive strain injuries
  - Overuse syndrome
  - Soft tissue disorder
  - Occupational overexertion syndrome

Musculoskeletal Disorders (MSDs)

- Bureau of Labor & Statistics – 2013
  - Average # of days off work before RTW – 11 days

- Treatment – Cost Effective & Time Limited
Shoulders 13%

- Common Shoulder Conditions
  - Biceps tendinitis
  - Impingement
  - Adhesive capsulitis
  - Instability
  - Subacromial bursitis
  - Rotator cuff tendinitis

Rotator Cuff Tendinitis

- Occupations
  - Power press operators
  - Painters
  - Assembly line operators
  - Welders
  - Postal workers
  - Landscapers
  - Nursing staff
  - Dental hygienists
“Rotator Cuff Tendinitis”

- Common, General Term for Shoulder Pain
- Alternative Term: Occupational Shoulder Pain
- Not Specifically the Medical Condition
- Proper Evaluation = Specific Diagnosis

Rotator Cuff Tendinitis

- Anatomy – Rotator Cuff – Shoulder
Rotator Cuff Tendinitis

□ Anatomy - Shoulder

Rotator Cuff Tendinitis

□ Symptoms

□ Pain (intermittent or constant; localized, diffuse or radiating, often aggravated by specific movement patterns)
   □ Especially overhead
   □ Limited motion (may be present)

□ Common Causative Factors

□ Awkward or static arm position
□ Working with arms overhead
□ Repetitive arm movement
□ Heavy work – direct load bearing (shoulder)
Rotator Cuff Tendinitis

- Medical Management
  - NSAIDs
  - Oral Steroid
  - Steroid Injection
  - Referral to therapy (pain reduction first)
- Days off Work...Typically
- Indications for Surgery (uncommon):
  - Lack of improvement after \( \approx 6 \) weeks
  - Return of symptoms with full duty work
  - MRI often ordered for more information

Rotator Cuff Tendinitis - Therapy

- Modalities - Pain Management
  - Hot or cold packs
  - Phonophoresis
  - Iontophoresis
Rotator Cuff Tendinitis - Therapy

□ Exercise
 □ Pendulum (Codman) [joint distraction]

![Exercise Image]

Rotator Cuff Tendinitis - Therapy

□ Exercise
 □ Active-assisted
   □ Restore joint ROM
   □ Restore soft tissue flexibility

![Exercise Image]
Rotator Cuff Tendinitis - Therapy

- **Exercise**
  - **Tubing exercises**
    - Strengthening – External & internal rotators

- **Tubing Exercises – Rationale**
  - Weakness in the rotator cuff
  - Results in the humeral head migrating to the acromion (less joint space)
  - Compression to the rotator cuff
  - With repetition, gradually develop inflammation and microscopic tears to the rotator cuff
  - Restore muscle balance – humeral head stays depressed, allowing ↑ joint space
Rotator Cuff Tendinitis - Therapy

□ Rationale – Tubing Exercises

□ Patient Education
  □ Limit overhead activities
    □ Rotate with activities - arms beside the body
    □ Limit static positioning of the arms overhead
    □ Limit arms away from body with weighted resistance
  □ Take rest breaks
□ Typically...4-6 Therapy Visits
Rotator Cuff Tendinitis

- Surgery
  - Arthroscopy: Subacromial cleanup and bone spur removal, cleanup of rotator cuff
    - May need full thickness cuff tear creation and repair
  - Outpatient surgery
  - Gradual return to ROM and strengthening over 6-8 weeks

Arm [Elbow] – 4%

- Common Elbow Conditions
  - Triceps tendinitis
  - Biceps tendinitis
  - Radial tunnel syndrome
  - Medial epicondylitis
  - Cubital tunnel syndrome
  - Lateral epicondylitis
Lateral Epicondylitis – “Tennis Elbow”

- Occupations
  - Luggage handlers
  - Carpenters
  - Painters
  - Plumbers
  - Meat cutters
  - Car mechanics
  - Assembly line
  - Roofers
  - Computer operators

Lateral Epicondylitis

- Anatomy – Lateral Elbow
  - Extensor Carpi Radialis Brevis
    - Holds wrist stable during use and work
Lateral Epicondylitis

- **Symptoms**
  - Point tender – lateral elbow
  - Pain – supination/wrist extension

- **Causative Factors**
  - Repetitive motion (wrist extension & elbow extension against resistance)

- **Medical Management**
  - NSAIDs/Steroids?
  - Steroid injection
  - Therapy: braces/splints, massage, treatments, position training

- **Days Off Work...** *Typically*

- **Indications for Surgery (rare):**
  - Continued symptoms for at least 12-18 months
  - < 10% of patients
Lateral Epicondylitis - Therapy

- Four Phase Therapy Program
  - Stage 1 – Relieve pain & patient education
  - Stage 2 - Restore active flexibility
  - Stage 3 - Restore passive flexibility
  - Stage 4 - Rebuild endurance & strength

- Patient Handouts –
  - Carefully explains the exercises & key instruction regarding movement patterns to avoid
  - Program – home & at work
Lateral Epicondylitis - Therapy

□ Stage 1: Relieve Pain & Patient Education
  □ Immobilization
  □ Light, soft tissue massage (gradually ↑ pressure)

□ Stage 1: Patient Education
□ Keep it Simple...
  □ Lift with palms up – all activities
  □ Keep arms close to body

*What this accomplishes...*
  □ Avoids static and/or weighted resistance when the arms are away from the body
  □ Avoids “hoisting” weighted objects from palm down to palm up position
Lateral Epicondylitis - Therapy

- **Stage II** – Active Stretching [10 reps-15 sec.]
- **Stage III** – Passive Stretching [same exercises]

- Prolong Stretch [15 – 30 seconds]
  - Lengthening of the muscle-tendon unit
  - Reduces strain/force along the muscle origin
  - Greater flexibility of the soft tissues to absorb resistive loads with movement

The Effect of Time and Frequency of Static Stretching on Flexibility of the Hamstring Muscles
Lateral Epicondylitis - Therapy

- Modalities – Persistent Pain
  - Ionotophoresis
  - Phonophoresis
  - ↓ pain, which facilitates progress through the stretching exercises

Lateral Epicondylitis - Therapy

- Stage IV – Endurance & Strength Building
  - Elbow bent initially; gradually straighten
  - Gradually increase weight
  - Typically...3-5 Therapy Visits
Lateral Epicondylitis - Therapy

- **Preference:** Avoid Augmented Soft Tissue Mobilization (ASTM) – Graston Technique
  - Limited muscle tone

Lateral Epicondylitis

- **Surgery**
  - Removal of damaged tissue either open or arthroscopically
  - 4-6 weeks of splinting and gradual return of motion then strengthening over 2-3 months
Cubital Tunnel Syndrome

- Occupations
  - Desk work [computer/phones]
  - Mechanics [tools with vibration]
  - Carpenters
  - Painters
  - Assembly line workers
  - Cashiers
  - Musicians

Cubital Tunnel Syndrome

- Anatomy – Elbow

- Ulnar Nerve (funny bone nerve)
Cubital Tunnel Syndrome

- **Symptoms**
  - Tingling, numbness – ring & small fingers
  - Pain/ache of elbow
  - Clumsiness
  - Weakness

- **Causative Factors**
  - Sustained elbow flexion
  - Repetitive elbow flexion
  - Prolonged pressure on elbow (hard surfaces)

- **Medical Management**
  - NSAIDs
  - Oral steroids
  - Therapy

- **Days Off Work... Typically**

- **Indications for Surgery (fairly common)**
  - Lack of improvement after 4-6 weeks of treatment
  - Nerve studies may be ordered
  - Any severe cases; permanent impairment
Cubital Tunnel Syndrome - Therapy

- Rest & Protection – Ulnar Nerve
  - Elbow pad
  - Elbow splint
  - Bed pillow

Rationale: Partial Elbow Flexion

![Graph showing pressure within the cubital tunnel vs. elbow flexion angle]

Acceptable Range
**Cubital Tunnel Syndrome - Therapy**

- **Patient Education**
  - Avoid the elbow resting on hard surfaces
    - Tables
    - Car window
    - Chairs with arm rests
  - Avoid sustained elbow flexion (> 90°)
  - Sleep with elbow partially bent
    - Pillow or splint
- **Typically...1-2 Therapy Visits**

**Cubital Tunnel Syndrome**

- **Surgery**
  - Open of endoscopic release of all possible compression points
  - Nerve transposition may be necessary
  - Gradual return to use over 6 weeks
Wrist – 3%

- Common Conditions – Wrist
  - Tendinitis – wrist flexors & extensors
  - DeQuervain’s tenosynovitis – wrist & thumb
  - Ulnar nerve compression – wrist
  - Tenosynovitis – flexor & extensor tendons
  - **Carpal tunnel syndrome**

Carpal Tunnel Syndrome

- Occupations
  - Desk work – computers/mouse
  - Meat – poultry workers
  - Garment workers
  - Assembly work
  - Cashiers
Carpal Tunnel Syndrome

- **Anatomy – Wrist**

- **Median Nerve**

Carpal Tunnel Syndrome

- **Symptoms**
  - Tingling in the hand (thumb to ring)
  - Numbness (intermittent or constant)
  - Pain
  - Weakness (long term CTS)

- **Causative Factors**
  - Repetitive hand motion
  - Sustained wrist flexion
  - Mechanical vibration or cold
  - Pre-existing medical conditions (diabetes)
**Carpal Tunnel Syndrome**

- Medical Management
  - NSAIDs and oral steroids
  - Steroid injection
  - Referral to therapy
- Days Off Work... *Typically*
- Indications for Surgery (common eventually)
  - Continued persistent symptoms
  - Return of symptoms with return to full duty
  - Severe cases

**Carpal Tunnel Syndrome – Therapy**

- Immobilization – *Resolve &/or ↓ Symptoms*
  - Custom-fabricated splint [contour along the wrist]
  - Pre-fabricated splint [hard, metal stay – volar wrist]
Carpal Tunnel Syndrome – Therapy

□ Tendon & Nerve Gliding Exercises

Rationale:

- Favorably increase maximum tendon excursion & reduce adhesions/edema surrounding tendons in the carpal canal [↑ space ↓ pressure on the nerve]
- Maximize nerve gliding to redistribute areas of pressure along the median nerve

Nerve and Tendon Gliding Exercises and the Conservative Management of Carpal Tunnel Syndrome

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ABSTRACT: While developments continue in the surgical management of carpal tunnel syndrome, little attention has been given to non-surgical options for its treatment. In this study, 117 patients 26 had pain of less than 1 year's duration and were randomized into 2 groups. In the first group, patients were treated with standard conservative means (medication and therapy), and those in the second group also performed nerve and tendon gliding exercises. There were no significant differences in outcomes between the 2 groups. A third group, who did not perform the nerve and tendon gliding exercises, had a worse outcome.
Carpal Tunnel Syndrome – Therapy

□ Patient Education
  □ Limit repetitive activities – wrist & hand (especially tight, sustained grip with wrist flexion)
  □ Avoid extremes of wrist motion
  □ Perform flexibility “stretching” exercises – work
  □ Ensure a proper computer workstation, keyboard & mouse [same considerations apply for a laptop and/or a tablet]

Carpal Tunnel Syndrome - Therapy

□ Flexibility Exercises
  □ Recover from static or awkward body positioning
  □ ↑ range-of-motion
  □ ↑ muscle-tendon lengthening
  □ ↑ power
  □ ↑ muscle balance
  □ ↑ circulation – promote healing

□ 2-3 Times a Day
  □ 5 minute sessions
Carpal Tunnel Syndrome - Therapy

- **Flexibility Exercises**
  - Patient handout

- **Proper Computer Workstation**
  - Sitting & standing
Carpal Tunnel Syndrome - Therapy

□ Computer Workstation – Standing

- Headset – phone

Work Station Design

Proper body positioning at your computer work stations is extremely important to maintain good physical health. To ensure your work station is ergonomically correct, please check the following:

1. Monitor screen – eye level and at arm's length away
2. Elbows – rest next to the body
3. Elbows – bent at 90 degrees
4. Wrists – neutral (straight) position
5. Table / Keyboard – allows elbows to bend 90 degrees
6. Mouse – mouse is placed beside the keyboard
7. Knees – level or slightly lower than hips
8. Feet – rest on the floor or on a footrest
9. Chair seat – soft edge by knees
10. Chair seat – approximately 18 inches wide
11. Chair seat – approximately 19-21 inches deep
12. Chair back – low and middle back support
13. Chair height – adjustable, allowing feet to rest flat on the floor
Carpal Tunnel Syndrome - Therapy

- Keyboard & Mouse

There is NO magic cure...

- No matter what the Internet might suggest!

Typically... 1-3 Therapy Visits
Carpal Tunnel Syndrome

- **Surgery**
  - Open or endoscopic release of transverse carpal ligament
  - Palm tenderness for several weeks
  - Return to work depends on job description
    - 1 day vs. 6 weeks

Hand - Fingers 2%

- **Common Medical Conditions**
  - Flexor tenosynovitis
  - Extensor tenosynovitis
  - Arthritis
  - Mucous cysts
  - Paronychia
  - Raynaud’s
  - Trigger thumb
    - *Trigger finger – Stenosing tenosynovitis*
Trigger Finger

- Occupations
  - Painters
  - Meat packers
  - Poultry workers
  - Electronic assemblers
  - Hand tools with pistol lever
  - Garment workers
  - Landscapers
  - Desk work – computerrrs & mouse

Trigger Finger

- Anatomy
Trigger Finger

**Symptoms**
- Gradual onset
- Pain in palm
- Progressively ↑ incidence of catching, snapping, locking of the finger with use of the hand

**Causative Factors**
- Compression with hand tools
- High repetition, high force activities – hand
- Sustained, static positioning of individual fingers

**Predisposing Medical Conditions**
- Metabolic conditions [alters connective tissues]
  - Diabetes
  - Rheumatoid arthritis
  - Gout
  - Hypothyroidism
  - Dupuytren’s disease
  - Carpal tunnel syndrome & carpal tunnel release
  - Injuries such as: wrist/metacarpal fractures, flexor tendon repairs, flexor tenolysis
Trigger Finger

- **Medical Management**
  - Warm soaks
  - NSAIDs and oral steroids
  - Steroid injections (up to 3 times!!)
- **Days Off Work...Typically**
- **Indication for Surgery (common)**
  - Continued or recurrent pain/triggering

Trigger Finger - Therapy

- **Immobilization**
  - Custom splint – block MP joint extended (straight)

Soft, neoprene sleeve
Trigger Finger - Therapy

- **Rationale – Blocking MP Joint in Extension**
  - Reduces the mechanical pressure along the A1 pulley
  - Relieves the friction between the flexor tendons and the pulley

![Diagram](image)

- ↓ friction on the tendon – along edge of A1 pulley

![Diagram](image)
Trigger Finger - Therapy

**Exercises**
- Maintain independent tendon gliding
- Stretch the small, intrinsic muscles

**Ergonomic Tools**
- Handles
  - Contoured (arch of the palm)
  - Wide
  - Soft
- Negligible resistance opening/closing the tool
Trigger Finger - Therapy

- **Patient Education**
  - Limit repetitive motion digits – work & avocational interests
    - Knitting, crochet, sewing, gardening, musical instruments
  - All activities – composite fist
    - Avoid isolating individual fingers
  - Use ergonomically designed hand tools
    - Limit use of hand tools - isolate individual fingers

- **Typically...1-3 Therapy Visits**

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Trigger Finger

- **Surgery**
  - Open of limited open release of first pulley
  - May require partial tendon removal if severe
  - Return to work depends on job description
    - 1 day vs. 6 weeks
Algorithm - Steps for Solving a Problem

- Team Approach → Optimal Outcome
- Treatment → Controlled Cost & Time Limited

- Employer
- Safety Manager
- Therapist
- Patient
- Case Manager
- Physician

Employer Safety Manager

Physician

Patient

Case Manager

Therapist