A Guideline to the Cumulative Disorder of the Upper Extremity

In Sok Yi MD
Denver, Colorado
Synonyms

- Repetitive motion syndrome
- Repetitive strain injury
- Myofascial pain
- Occupational overuse syndrome
- Cumulative trauma disorder
Cumulative trauma disorder (CTD)

- Identifies a large group of conditions that result from traumatizing the body in either a minute or major way over a period of time. It is the build up of trauma that causes the disorder.

- However, cumulative trauma disorder is **not** a diagnosis.
Incidence of CTD

- 37.8/10,000 full time workers (Bureau of Labor Statistics)
- 83.1/10,000 full time workers in Washington State
After a backyard bbq
Limiting traffic
Watering
Sunlight
Fertilizing
With neglect or continued bbq
the lawn never recovers
How does CTD occur

- Muscle and tendons have the ability to heal when given proper rest and nutrition.
- If the force of insult is too great for the structure to heal, there is an acute injury.
- If there are chronic repetitive insults to the structure and the structure does not get proper rest or nutrition, the structure can also be injured.
With proper nutrition and proper workout routine, muscles can be conditioned. Or with improper rest, nutrition and conditioning, it can cause injury.
Models for CTD

- Rats exposed to HRLF and HRHF. With time % of successful reaches increased. Indicative of skill acquisition
- Some HRHF rats received NSAIDS, which increased reach rate and force. Indicative of inflammation
- Increased incidence of upper extremity injuries in wheelchair patients (Cooper 1998)
3 stages of CTD (Browne & Nolan 1984)

- Discomfort, aching, and fatigue that diminish at night. Reversible
- Symptoms do not resolve between work sessions. Will now have objective physical signs. With extended rest symptoms subside
- Symptoms do not resolve and persist after extended rest period
Stages of CTD (AMA guidelines 3rd edition revised)

Stage 1
1-2 symptoms and improvement with rest and activity modification
Or minimal problems with ADL 0-11%

Stage 2
2 or more symptoms and improvement but will not resolve completely with rest and activity modification or noticeable aggravation by more difficult ADL 11-20%

Stage 3
3 or more symptoms and symptoms do not improve with modification but may improve with elimination of specific aggravating activity or significant interference with ADL 21-30%

Stage 4
3 or more symptoms and do not improve with elimination of specific aggravating activity or severe limitation of ADL 31-40%
What internal factors are involved with developing CTD

- Age
- Gender
- High BMI
- Pregnancy
- Underlying medical problems
  - Diabetes
  - Rheumatoid arthritis, degenerative arthritis
  - Hypothyroidism
  - Cancer
- Psychological issues
What external forces are involved in developing CTD:

- High force
- Awkward or static posture
- Poor tool and equipment design
- Fatigue
- Repetition
- Temperature extremes
- Vibration
Risk Factors upper-extremity musculoskeletal disorders in the working population (Roquelaure 2009)

- French working population
- Incidence of disorder 1/472
- Risk factors: age, prior history of disorder
  - Men: obesity, high level of physical demand, high repetitiveness, posture with arms elevated, posture with elbow fully flexed, high psychological demand
  - Women: diabetes mellitus, posture with extreme wrist flexion, use of vibration tools, low level of decision authority
What happens to tendons as it ages?

- **Extracellular:** water and mucopolysaccharide content decrease which increases the stiffness of the tendons.

- **Intracellular:** decrease in the volume density of the tenoblasts as well as the number of tenoblasts per unit of surface area. The decrease in the organelles within the tenoblasts especially the endoplasmic reticulum. There are less tenoblasts and the remaining ones are not as effective to repair injury.

- These changes start at about 25 years old at the cellular level.
How about muscles?

Muscle strength and mass reduce with age.
Miller 1995

- He feels that a big part of muscle strength and muscle mass reduction is due to physiologic nerve changes causing atrophy of the type II fiber.
  - Reduce number of nerve fibers
  - Changes in the nerve fiber membrane
  - Reduction in nerve fiber size
Cumulative Trauma Conditions
revised: 9/16/2010

- Aggravated arthritis
- deQuervain’s tendonitis
- Medial and lateral epicondylitis
- Extensor tendonitis
- Flexor tendonitis
- Triangulofibrocartilage complex tears
- Ganglion cysts of the wrist
- Trigger finger
- Carpal tunnel syndrome
- Cubital tunnel syndrome
- Guyon’s canal syndrome
- Posterior interosseous nerve entrapment
- Pronator syndrome
- Radial tunnel syndrome
Primary Risk Factor Definitions

Force and repetition/duration
- 6hrs >50%max effort 3-5kg
- 6hrs lifting>10# 60/hr
- 6 hrs use of hand tool >2#

Awkward posture
- 4hrs wrist flexed >45, extension>30 or ulnar deviation >20
- 6 hrs elbow flexed >90
- 6 hrs sup/pron task cycle
Primary Risk Factor Definitions

- **Computer work**
  - >4hrs of mouse use
  - Up to 7 hrs/day of ergonomically correct workstation computer use is not a risk factor
- **Handheld vibratory power tools**
  - 6 hrs or more
- **Cold working environment**
  - <45F for >4hrs is a secondary risk factor
No strong studies relating a specific risk factor to a specific cumulative trauma condition. However, there are some good studies linking a specific risk factor to a cumulative trauma condition.
How to approach a patient with CTD

- Detailed history of pain quality, location, aggravating activities, duration, pain when away from work, hobbies, previous history of injury, psychological issues, work description, work environment and the risk factors previously stated.

- Detailed physical examination

- Appropriate laboratory testing
- Determine the diagnosis
  - CTD is not a diagnosis
  - If the pain is vague, then use a descriptive code such as wrist pain or elbow pain.
Medical causation assessment

- The work exposure caused a new condition
- The work exposure causes the activation of a previously asymptomatic or latent medical condition
- Work exposure combines with accelerates, or aggravates a pre-existing symptomatic condition

- Or, if the patient would need the treatment that the clinician is recommending if the work exposure had not taken place
How to eliminate CTD in an ideal world but politically incorrect

- Pre screen prospective employees to make sure they are physically fit to perform the work
- Gradually start on work conditioning prior to working full duty
- Rest and modify work environment at the onset of pain (stage 1)
- Point of this is that prevention of injury and pain is the most effective method in treating cumulative trauma conditions
Case 1

- 47 year old female with 3 month history of progressive worsening of right wrist pain and numbness and tingling. Numbness and pain wakes her from sleep at night. Pain is worse with mouse use, numbness and pain is worse with keyboarding. Has no elbow pain. Has pain in radial wrist with twisting. Hands go numb when she drives.

- Her office has been temporarily relocated 4 months ago and has her computer monitor on telephone books. Works as a data entry worker. New software requires increased mouse use for data entry.
Case 1

- Recently placed on a restricted diet due to high blood sugars by primary care doctor
- Likes to needle point and crochet as a hobby
Overweight female

Positive thumb compression test over the carpal canal at 20 seconds

Positive Phalen's test at 20 seconds

Negative tinels at carpal canal

No thenar atropy with good palmar opposition of the thumb

Slight decrease in sensation of the index finger compared to small finger

Positive Finkelstein test with tenderness over the first dorsal compartment

Mild tenderness over the thumb carpal metacarpal joint
Diagnosis

- Carpal tunnel syndrome
- Dequervain’s tendonitis
Is it work related?

- The work exposure caused a new condition
- The work exposure causes the activation of a previously asymptomatic or latent medical condition
- Work exposure combines with accelerates, or aggravates a pre-existing symptomatic condition
- Would she have this condition requiring treatment if the work exposure had not taken place
EMG now or after trial of conservative treatment?
- If there is thenar atrophy or significant weakness then EMG should be ordered now.

- Ergonomic evaluation
- Physical/occupational therapy
  - Nerve glides
  - Treatment for deQuervain’s
  - Night time splinting of CTS and deQuervain’s

- Possible injection for deQuervain’s tendinitis
She returns in 4 weeks with some improvement in wrist pain but continued numbness

Obtain EMG
- Sensory delay of 4.2ms
- Motor delay of 5.2ms
- No EMG changes of the APB muscle
Treatment options for CTS

- **Injection**
- **CTR**
  - Endoscopic vs open release
- **Results**
  - Should be able to return to work with modified activity 2-3 days post op.
  - Surgical pain and pillar pain should improve at 6-10 weeks on average
  - 6 months the strength should be about 10-20% stronger
  - 3-5% chance of recurrence
  - MMI around 3 months
Treatment options for deQuervain’s tendonitis

- Injections

- 1st dorsal compartment release

- Results
  - Very good success rate >90%
  - 8-12 weeks for MMI

- Complications
  - Infection, stiffness, residual pain, scar sensitivity, superficial radial nerve neuritis, dislocation or subluxation of the tendons, RSD
Case 2

- 45 year old female with left lateral elbow pain for 6 months. She prepares all the month end reports for the company. In the past she would have pain in the elbow and would resolve during the slow time of the month but now it is constant. Pain with computer work, handling files. No numbness.

- Ergonomic workstation setup has helped somewhat but still has significant pain during the busy time of the month.
No other medical problems

No other history of trauma

No prior history of work injury
Physical Exam

- Tenderness of the lateral epicondyle
- Pain with resisted wrist extension
- Pain over the elbow about 2-3 cm distal to lateral epicondyle
- Mild tenderness with resisted wrist extension
Is it work related?

- **Good evidence for specific risk factor**
  - Combined awkward posture (>45 degrees of supination) and forceful lifting
  - Combined force and repetition

- **Some evidence for specific risk factor**
  - Combination of repetition and awkward position including static posture
What if she was a weekend tennis player?

If her work load was constant with an ergonomically correct workstation?
Treatment

- Injection
  - Steroid
  - Autologous blood
  - PRP
  - Botox

- Extracorporeal shock wave therapy

- Surgical release
  - Percutaneous
  - Arthroscopic
  - Open release +/- radial tunnel release
  - Denervation of the lateral elbow
Results

- Fair
  - I do not believe in Nirschle who claims 90% success rate
  - Usually improved symptoms after release but rarely pain free
  - 4-6 months until MMI
Case 3

- 32 year old construction worker with progressively worsening wrist pain for the past 6 months in his dominant right hand. Denies previous injury or recent injury. Works with vibration tools.

- No medical problems

- Smokes 1/2ppd
Physical exam

- Mild wrist swelling
- Decreased range of motion of the wrist
- Pain over dorsal wrist over the area of the lunate
Radiographic studies
Is it work related?

- Can be associated with trauma, either single or repeated episodes.
- More common in people with lupus, sickle cell anemia, cerebral palsy.
Treatment

- Splint/cast
- Surgical
  - Osteotomy
  - Revascularization
  - Results are mixed depends on the stage preop
75 year old female with pain in the base of the right dominant thumb for the past 3 months after trying to pick up a heavy folder/file at work. Pain with pinching, pulling up her pants and writing. Mild numbness and occasional clicking of the thumb.
Physical exam

- Pain at the thumb basal joint with thumb grind test
- Prominence at the base of the thumb
- Negative thumb compression test over the carpal tunnel
- Small palpable nodule at the level of the A1 pulley
Is it work related?

- Common in females over the age of 40.
- Cause unknown but factors include genetics, previous fracture or dislocations, generalized joint laxity
Treatment

- Splints
- Injection
- Surgery
  - Partial of complete excision of the trapezium
  - With or without interposition
  - With or without ligament reconstruction
  - Some interposition with prosthesis
Results

- Good pain relief
- Restoration of functional range of motion
- Residual weakness
Questions?
Thanks!