"How to keep your hands healthy"
Thumb Arthritis Prevention

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Check out your own Left Thumb “Rotation” (Edmunds, 2006)
NO TWO THUMBS ARE ALIKE
Carpometacarpal (CMC) joint

- Joint surfaces are not congruent
- Stability from soft tissues
- Ligamentous support
- Muscular support
Human Thumb: Unique Features

- Chimpanzee – more constrained
1st CMC Joint

- Functionally a universal joint
  - Allows movement in 2 planes at right angles
  - Accessory movement of automatic rotation of the moving part on its long axis
Ligaments-Anterior oblique

(Edmunds, 2006)
1st dorsal interosseus
Theories of deformity
Who uses their thumb CMC joint?

Dental Hygienists
Homemakers
Carpenters
Musicians
Metal Workers
Chefs, Waitresses
Massage Therapists
Flight Attendants
Trauma Victims
One-handed People
Occupational Therapists
Physical Therapists
Surgeons and YOU!?!
Varieties of Thumb Pain

- Trigger thumb
- Sprained thumb
- Ligament laxity of IP, MCP and CMC
- Hypermobility Syndrome: Ehler-Danlos Syndrome
- Fractures
- Neurologic injuries which cause pain
- Systemic Diseases which affect each joint: RA, OA, scleroderma
What is the prevalence of CMC OA?

- most prevalent onset age 55-64 years
- 6% prevalence in men
- 25% prevalence in post-menopausal women (of those, only 28% were symptomatic)
- Radiographic presence of CMC arthritis did not predict work disability
- Association with physical workload history is not significant
- Increased Body Mass Index (BMI) correlated with CMC arthritis

Female vs. Male
Carpometacarpal Joint

- Females
  trapezium
  smaller, flatter,
  less congruent

- Female
  cartilage is
  thinner

- Hormonal
  changes

(Kovler, Lunon, McKee, & Agur, 2004)
(Theis, Helmick & Hootman, 2007) (Hagert & Ladd, 2012)
"Thumb Pain" from Arthritis

CMC Osteoarthritis
- Cartilage degeneration/stages
- Many Treatment options

STT Arthritis
- Scaphoid, Trapezium, Trapezoid

Rheumatoid Arthritis
- Synovial – usually bilateral
- Different treatment options
Why is the human thumb at risk for pain?

Is it because there is only a 35 year warranty on the 1st CMC joint?

What is the mystery of dynamic stability for the CMC joint?

Can something be done about it?

YES!
Thumb CMC Arthritis

• Very common dx in Hand Surgeon & Therapist’s office
• 2\textsuperscript{nd} most common joint affected by OA
• Highest prevalence of request for operative management
• Hand OA is greater in elderly females, with thumb CMC being the most painful
• Pinch forces translate up to 12-14x greater at CMC jt


This is arthritic CMC!
Tablets

SmartPhones

Video games

Electronic Readers

Electronic Reader for Kids

Now THIS! Note: lateral pinch, adducted pinch, and static abnormal postures
EVALUATION

**PHYSICIAN:**
- Signs and Symptoms
- Differential diagnosis
  - Provocative tests
- Radiographic Classification
- Treatment
  - Non-operative
  - Operative

**THERAPIST:**
- Signs and Symptoms
  - ROM and strength measures
- Differential dx with provocative tests
- MD orders
- Treatment:
  - Orthoses/splints
  - Exercises/manual trt
  - Joint protection
Signs and Symptoms

- **Symptoms**
  - Pain with thumb use
  - Diffuse ache
  - Weakness

- **Physical Exam Tests**
  - Digital pressure over capsule of CMC joint
  - Grind test
  - Differential Injections
    - Intra-articular lidocaine
Signs and Symptoms

- Physical Exam Signs
  - Local Swelling/Warmth
  - Adduction Deformity
    - 1st webspace contracture
  - MCP hyperextension
  - Zigzag Collapse
Differential Diagnosis

- DeQuervian’s tenosynovitis
  - (FPL Trigger thumb)
- FCR tendonitis
- Carpal Tunnel Syndrome
- Scaphoid Pathology
  - Nonunion Fractures
  - Preiser’s Disease
    - AVN of scaphoid
- Arthritis of other joints
  - Thumb MCP
  - Radiocarpal
  - Scaphotrapezial joint
Radiographic Evaluation

CMC Stress View
Eaton Classification

Stage I

Stage II

Stage III

Stage IV
Cartilage Changes

Stage I

Stage II

Stage III

Stage IV
TREATMENT
Non-Surgical Treatments

- Steroid Injections
  - Gold Standard of injection therapy

- Steroid Injections with Splinting
Steroid Injections with Splinting

- Steroid Injection
  - 3 weeks pre-fabricated thumb-spica splint
  - F/u 18 months
  - N = 30
  - DASH - pre, 6 wk, 18 mo
- Xrays
  - Eaton Classification

- Pain Relief
  - Stage I – 5/6 had average 23 mo relief
  - Stage II/III – 6/17 had long-term relief at 18 mo
  - Stage IV – 6/7 had no short or long-term relief

Day et al, J Hand Surg Am, 2004
Surgical Procedures

- Stage III / IV
  - CMC Arthrodesis
  - Implant Arthroplasty
  - CMC Resection Arthroplasty
    - Trapeziectomy with or without ligament reconstruction
    - LRTI or various suspension-plasties: Internal Brace™
    - Implant arthroplasty—(seen much less often)
Indications for Treatment

- Pain and/or deformity that interferes with activities of daily living
- “We treat patients, not radiographs” (AVH)
The Goal is “Dynamic Stability”

What’s the plan?

How can we help the patient self manage his thumb pain and instability for a lifetime?
Key Points for a Stable Thumb

- Web space width is essential
- Adductor must be at length to allow enough web space for full opposition
- 1st Dorsal Interosseous is a KEY
  - stabilizes/seats the MC base into the saddle of the Trapezium, providing counterforce to subluxating forces
- Extrinsic must work in balance with Intrinsics
Observation of the Thumb

Adduction contracture

Hyperextension or deviation of MPJ

Shoulder appearance
Myofascial Release: Adductor muscle release: A KEY

- Ischemic pressure to release the muscle
- Manually
  or with spring clip
- Active/Passive open web
Joint Mobilization

- Completed **after** adductor muscle release, **before** strengthening to restore muscle balance.
- Approximates joint surfaces.
- Assists in restoring normal and stable thumb biomechanics and arthrokinematics.
- Must be done pain free!!!
Muscle re-education

- Re-education of the thumb muscles to restore stable balance

Focus:
- Abductor pollicis brevis and Opponens Pollicis
- 1st Dorsal Interosseous
- APB and Abductor Pollicis Longus
- Retrain Thumb to Stable C position for Function
ISOLATE Abductor & Opponens

Make the thumb puppet sing
The “C” position

- This is the most stable position for the CMC.
- Relax and repeat many times a day.
- Isotonic strengthening added as tolerated
Strengthen the 1st Dorsal Interosseous
1st Dorsal Interosseous Exercise

Rubber Band Exercise:
Abduct only the Index Finger away from Middle Finger

NEW GOAL: 100 repetitions per day???
Functional Muscle re-education:

- “Piano playing” strengthening, isometric to isotonic

- Learn to abduct without losing the MP flexion posture
Activation of the First Dorsal Interosseous Muscle Results in Radiographic Reduction of the Thumb CMC Joint

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Background

- Correlation between ligamentous laxity and thumb CMC OA (Jonsson 1996)
- High prevalence of thumb CMC arthritis in Ehlers-Danlos patients (Gamble 1989)
- Dynamic stabilization of the thumb CMC effective in reducing pain, improving function (QuickDASH) (O’Brien, 2013, Albrecht, 2008)
Hypothesis

Activation of the first dorsal interosseous (FDI) muscle reduces subluxation of the 1\textsuperscript{st} metacarpal relative to the trapezium.
Methods

- Recruitment of healthy volunteers >18 yo
  - Exclusion criteria: OA, pregnancy, medical condition associated with ligamentous laxity, positive grind test

- Grind test, grip and pinch strength, and maximal voluntary contraction of the FDI (Rotterdam Intrinsic Hand Myometer)
Methods

- APs of thumb CMC joint:
  1) At rest
  2) Manual radial translation stress
  3) Manual radial translation stress with activation of the FDI
  4) At rest with activation of the FDI

- Subluxation and metacarpal width measured by 3 blinded surgeons

Wolf 2009
Methods
Results

17 subjects (5 M, 12 F), 34 thumbs
- 2 thumbs excluded for positive grind and radiographic OA

13 RHD, 1 LHD, 3 ambidextrous

Average age 26 (21-59) years

Mean Maximum Voluntary Strength:
- FDI 27 N (RIHM)
- Pinch 81 N
- Grip 347 N
Results

ICC > 0.74

- Subluxation with Stress, Reduction with FDI Activation (27)
- No subluxation (3)
- Subluxation at Rest, No Further Subluxation with Stress (2)

9% 6%
Subluxation with Stress, Reduction with Activation of FDI (27 of 32)

- Subluxation with stress averages 0.6 (0.4-0.9) cm or 48% (29-75%) of AW
- Average of 0.5 (0.1-0.9) cm or 80% (20-120%) reduction in subluxation with FDI activation
No Subluxation at Rest or with Stress (3 of 32)
Subluxation at Rest, No Further Subluxation with Stress (2 of 32)

- Baseline subluxation of 0.5 cm (43% AW) and 0.7 cm (63% AW)
- Reduction with FDI activation 0.3 cm (67%) and 0.2 cm (28%)
Partial Reduction with FDI Activation
Subluxation/Articular Width Ratio with Stress +/- FDI

$t(31) = 10.5 (<0.001), d=2.64$

Hand Tested

- Right (n=17)
- Left (n=15)
- Combined (n=32)
Results

- The variability in stressed subluxation of the thumb CMC joint in a multivariate analysis (gender, age, hand dominance, normalized FDI strength) was explained only by maximal voluntary contraction of the FDI ($R^2 = .22, F(1,31)=7.76, p=.009$)

- No variable was statistically significant in correlating the degree of reduction of the CMC joint with FDI activation
Conclusions

- Activation of the FDI radiographically reduces subluxation of the thumb CMC joint

- Selective FDI strengthening maintains joint congruity which may be preventative in the progression of thumb CMC arthritis
References

- Practice thumb stability during functional tasks
- Explore the use of various adaptive tools

Have key adaptive tools available in clinic
Try out tools.....

Practice Techniques....

Test Splints...
Custom Splints: vary
“Working” splints should be custom made:

Consider the task:
Job simulation will help to decide materials, joint position and design.

Test the splint with the tasks:
The CMC Stabilization Splint

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“Resting” splints, “Prefabricated”

Many designs and more to come!
A lifetime of use without attention to good thumb posture contributes to deformity.
Thumb CMCJ Management

- Requires a team approach
- Dynamic Stability is the goal
- Patient able to carry out the program for a lifetime
THANK YOU FOR YOUR TIME AND ATTENTION

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