# "How to keep your hands healthy" Thumb Arthritis Prevention

Ann Van Heest MD

Professor, Dept of Orthopedic Surgery

Virginia O'Brien OTD, OTR/L, CHT

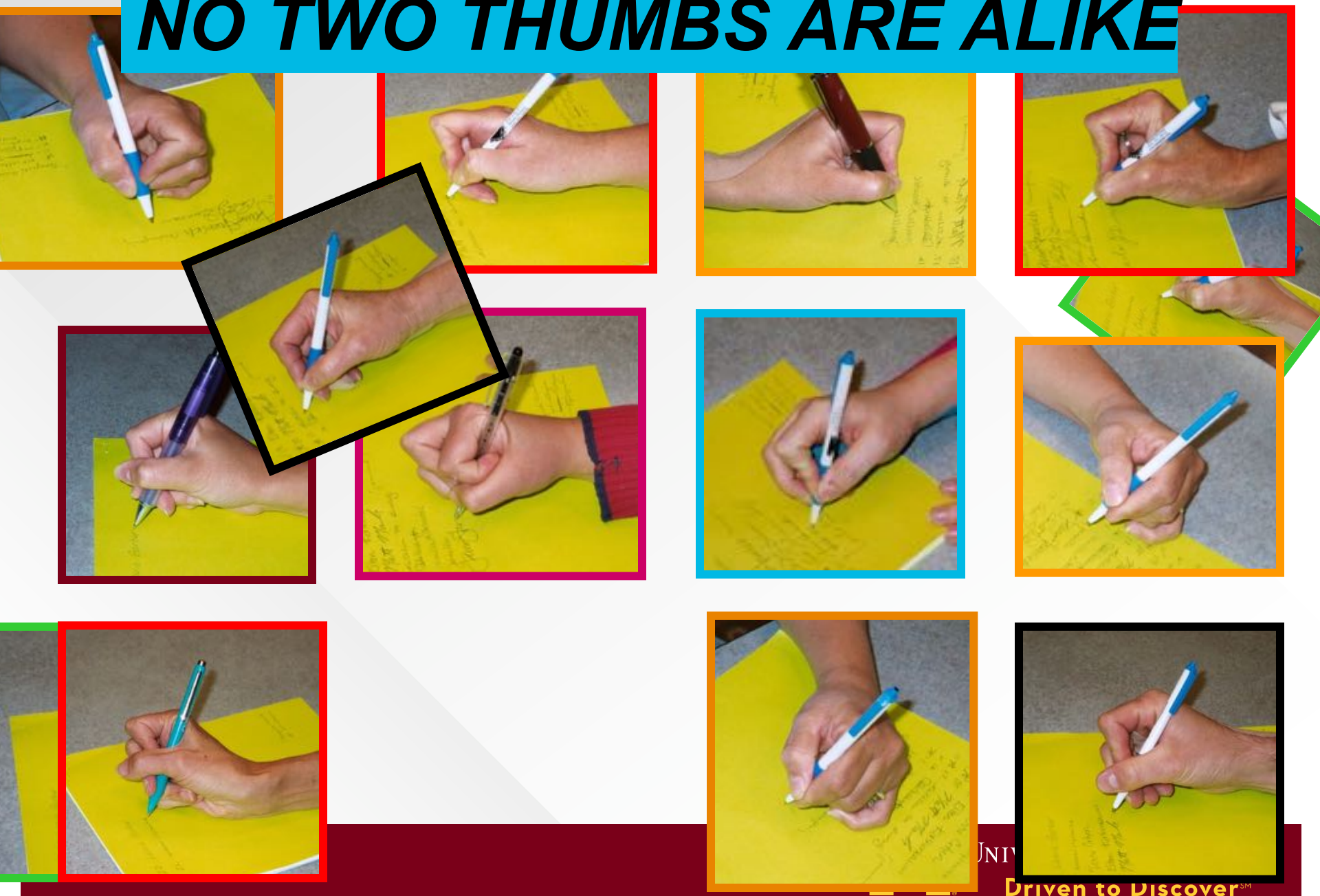
UNIVERSITY OF MINNESOTA

Driven to Discover℠

# Check out your own Left Thumb“Rotation”

( Edmunds, 2006)

# NO TWO THUMBS ARE ALIKE

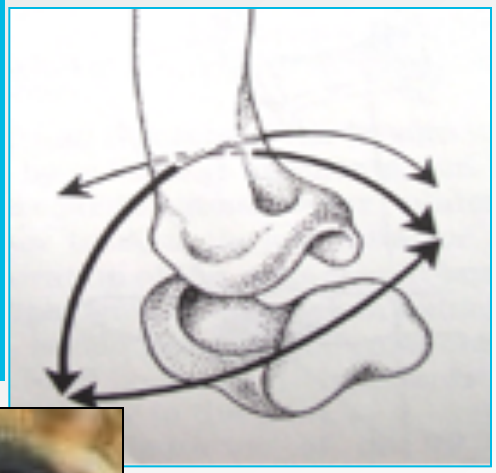


# Carpometacarpal (CMC) joint

- ***Joint surfaces are not congruent***
- ***Stability from soft tissues***

- ***Ligamentous support***
- ***Muscular support***

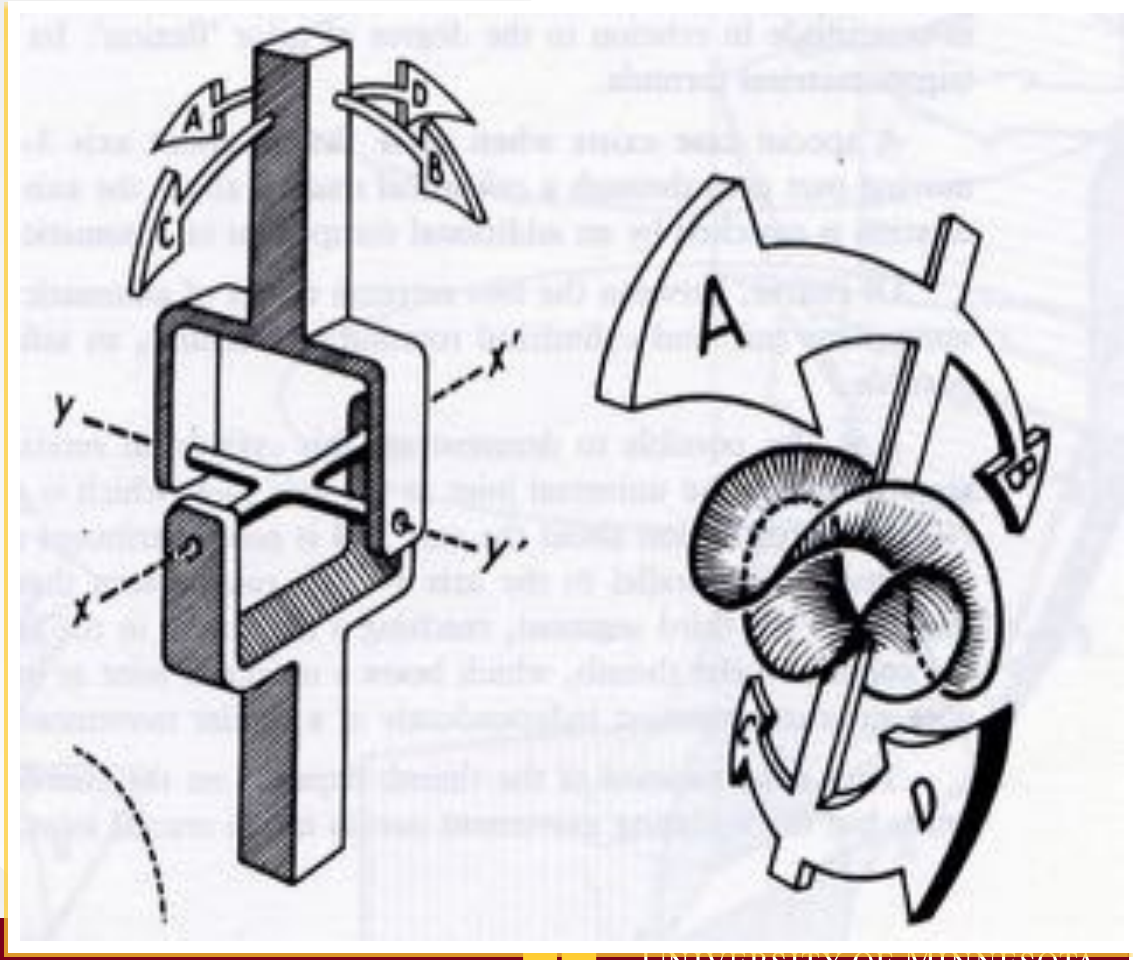
# Human Thumb: Unique Features



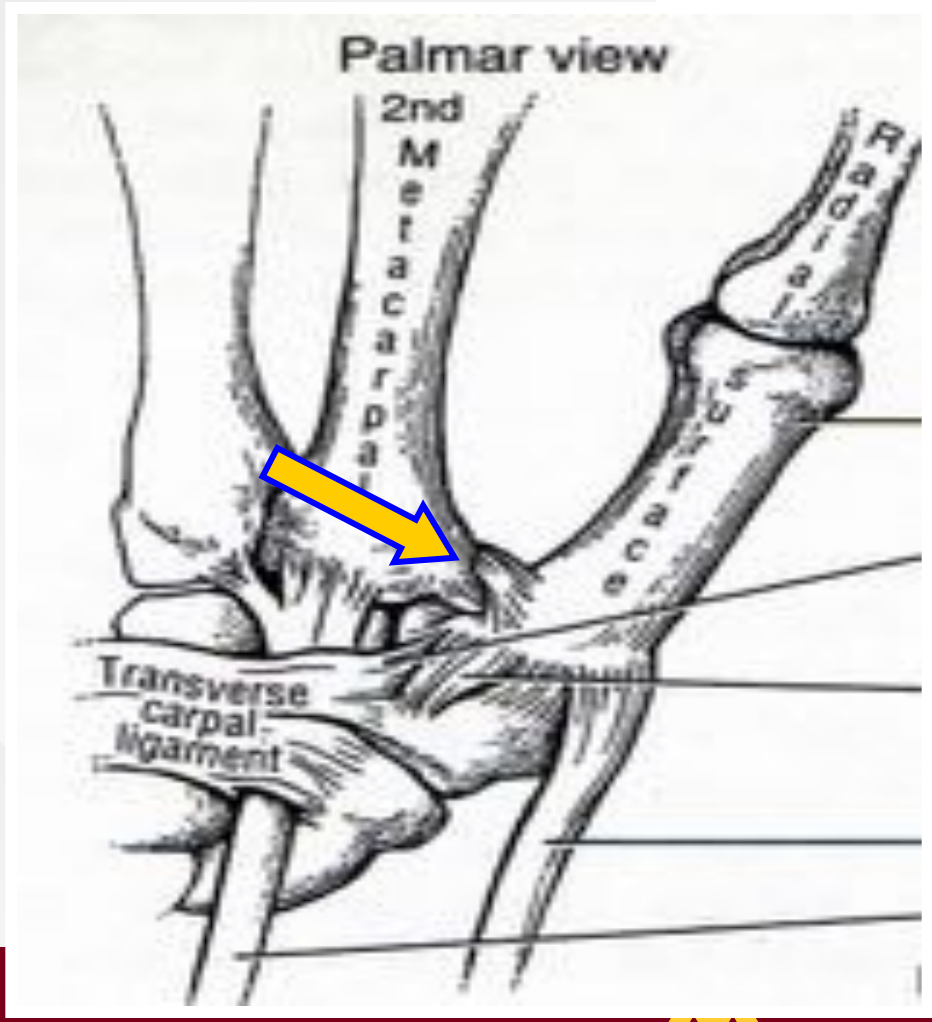

- Chimpanzee – more constrained

# 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

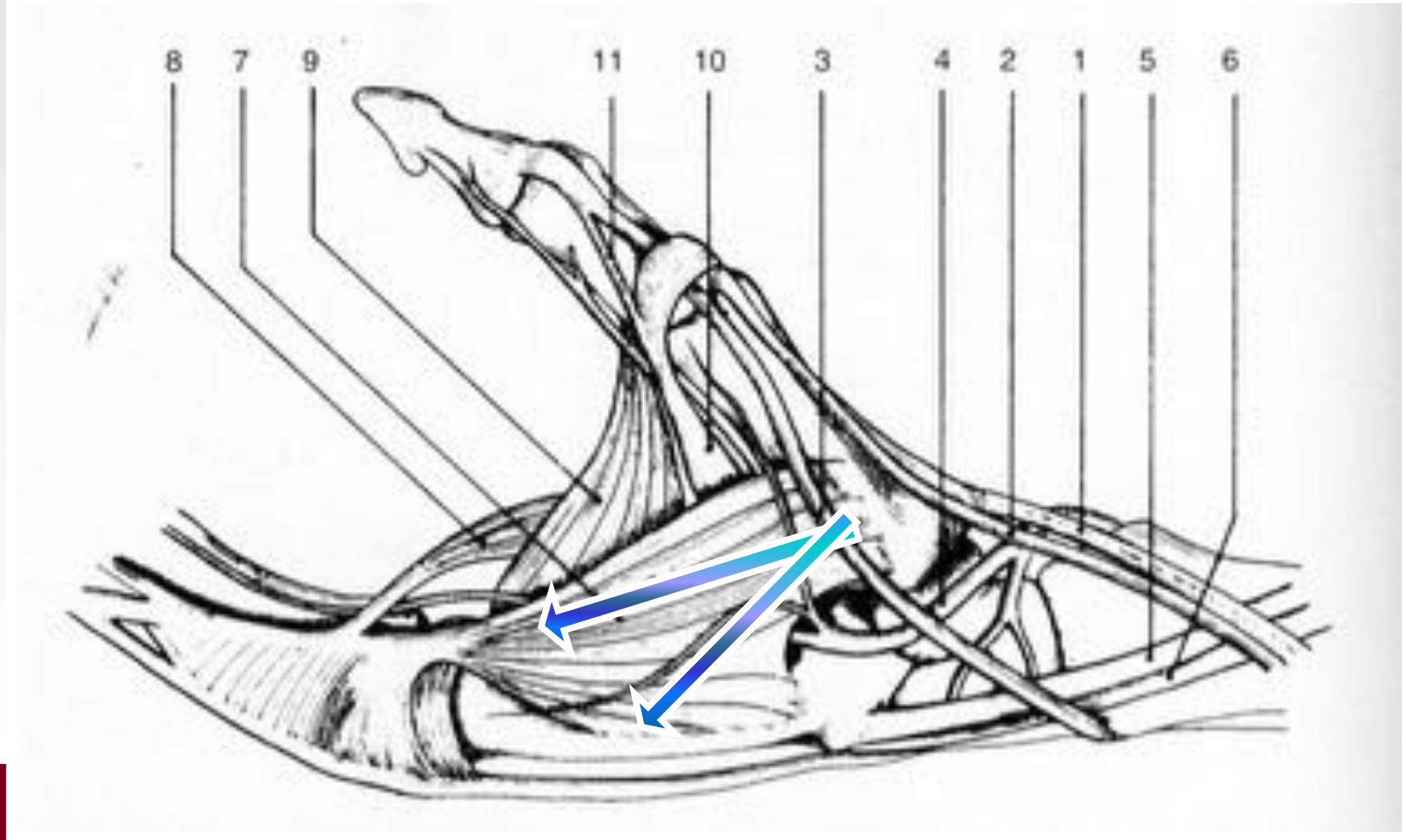


# Ligaments-Anterior oblique

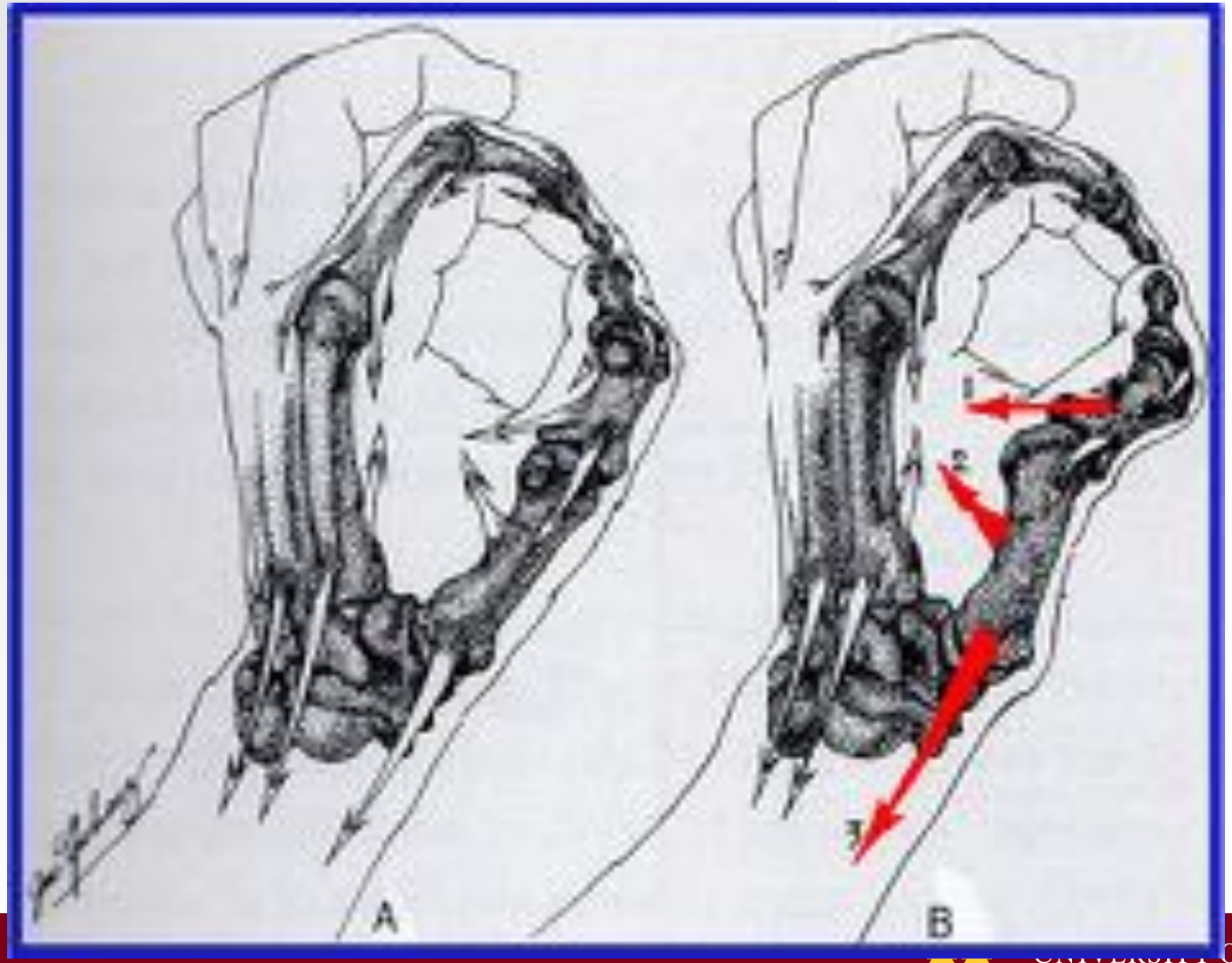



*(Edmunds, 2006)*

# 1st dorsal interosseus



# Theories of deformity




(Moulton, 2001)

# *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

*(Armstrong, Hunter, & Davis, 1994) (Haara, et al., 2004) (Van Heest & Kallemeier, 2008)*

# Female vs. Male Carpometacarpal Joint

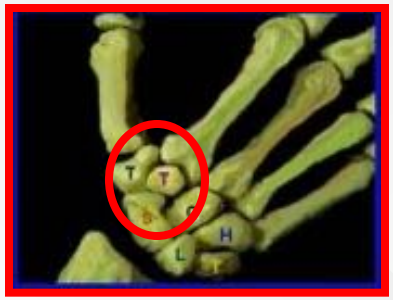
- Females trapezium smaller, flatter, less congruent
- Female cartilage is thinner
- Hormonal changes

(Kovler, Lumon, McKee, & Algur 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
- 2nd 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!***

***(VanHeest & Kallemeier, 2010)***

***(Dahaghin et al. 2005) (Zhang et al. 2007) (Theis et al. 2007)***

Tablets

SmartPhones

Video games

Electronic Readers

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

Electronic Reader for Kids

# 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

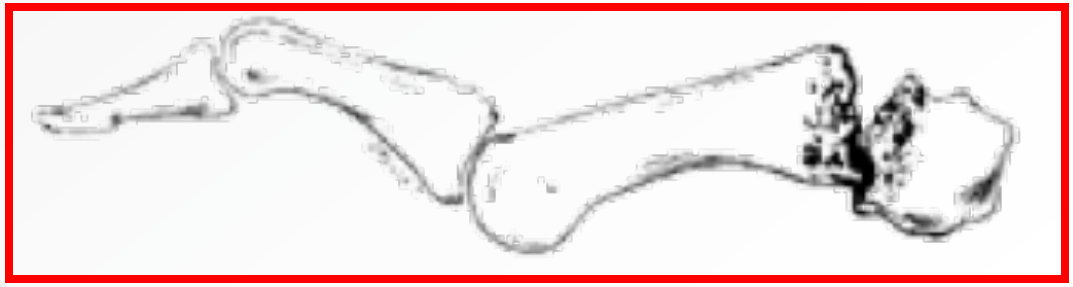
# Signs and Symptoms

- 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

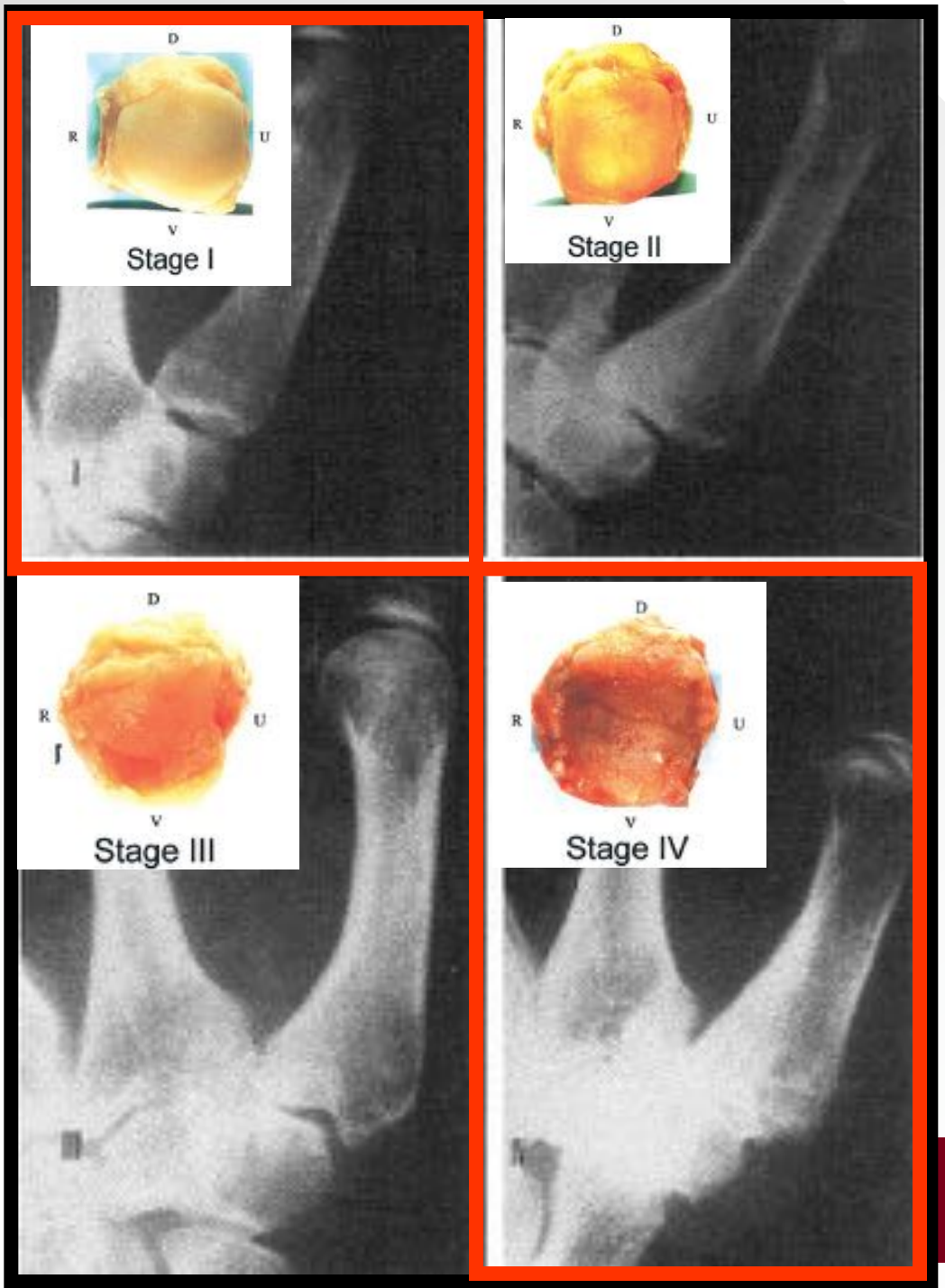


# Differential Diagnosis

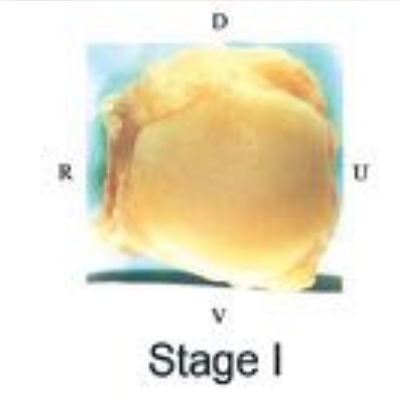
- DeQuervian's tenosynovitis
  - (FPL Trigger thumb)
- FCR tendonitis
- Carpal Tunnel Syndrome
- Scaphoid Pathology
  - Nonunion Fractures
  - Preiser's Disease
    - AVN of scaphoid
- Arthritis of other joints
  - Thumb MCP
  - Radiocarpal
  - Scaphotrapezial joint

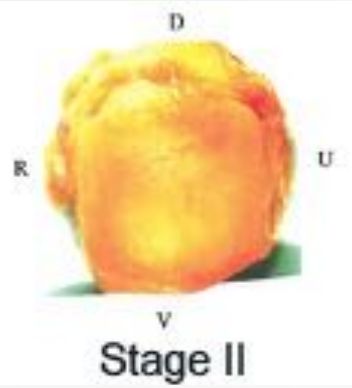
# Radiographic Evaluation

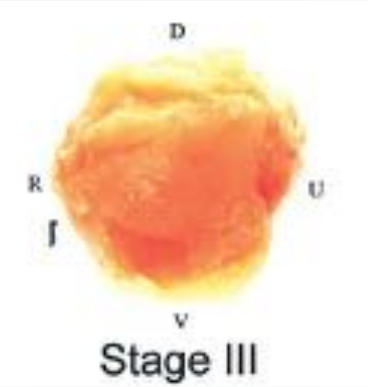
# Eaton Classification

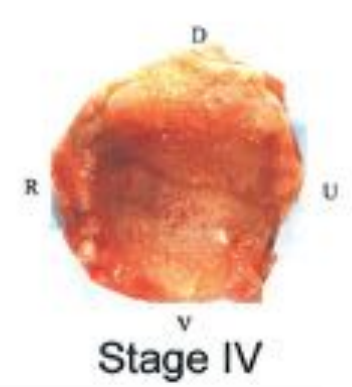


# Cartilage Changes



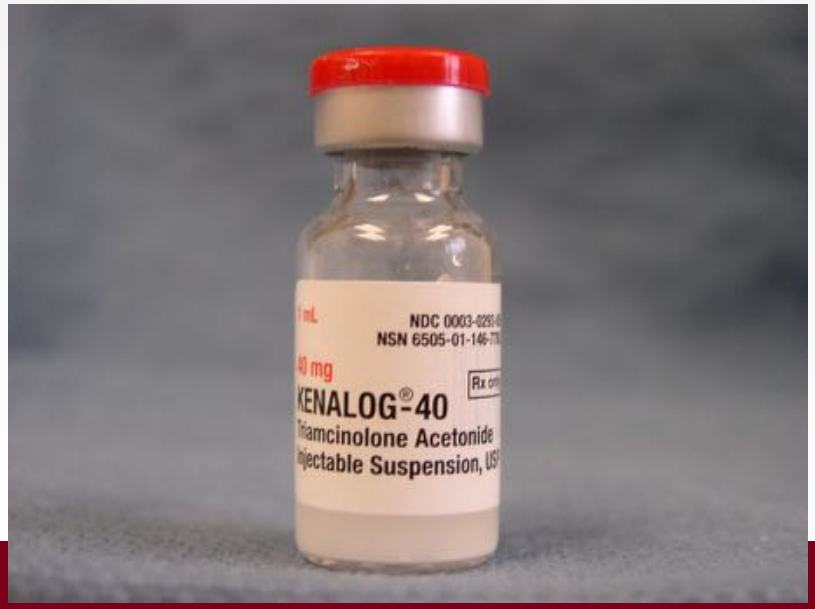



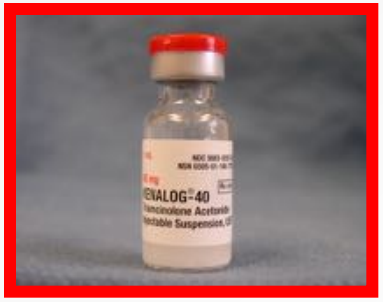
# TREATMENT

# Non-Surgical Treatments

- Steroid Injections
  - Gold Standard of injection therapy




- Steroid Injections with Splinting



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# 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 ave 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 life time?***

# 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
- Extrinsics must work in balance with Intrinsics

# Observation of the Thumb

***Adduction contracture***

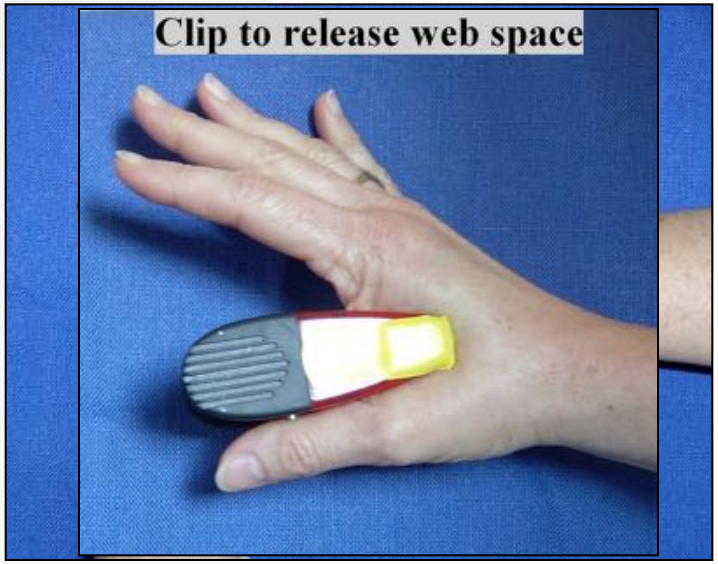
***Hyperextension or deviation of MPJ***

***Shoulder appearance***

# Myofascial Release:
# Adductor muscle release: A KEY

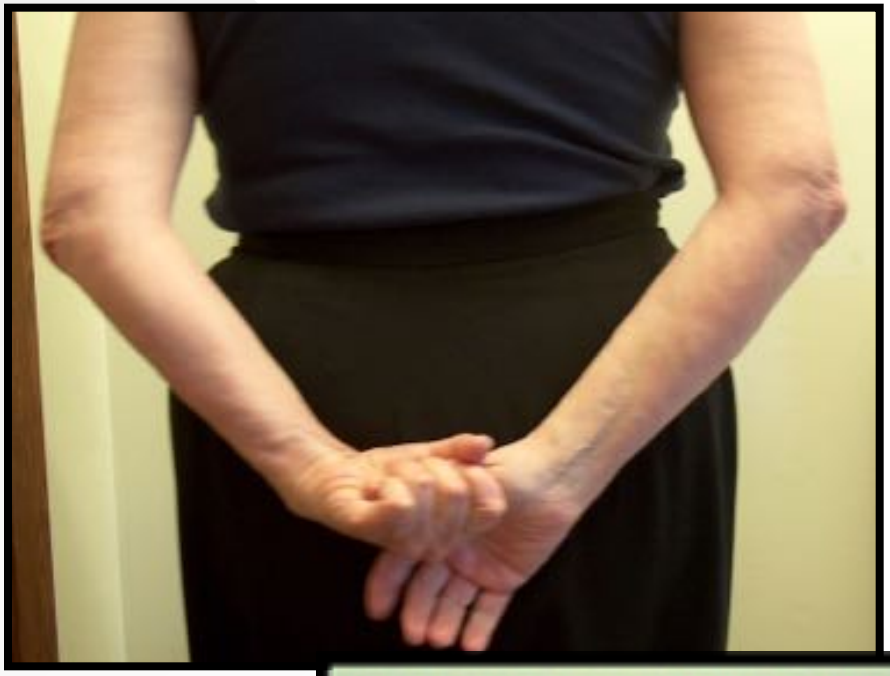
- Ischemic pressure to release the muscle
- Manually

  or with spring clip
- Active/Passive open web




# Joint Mobilization

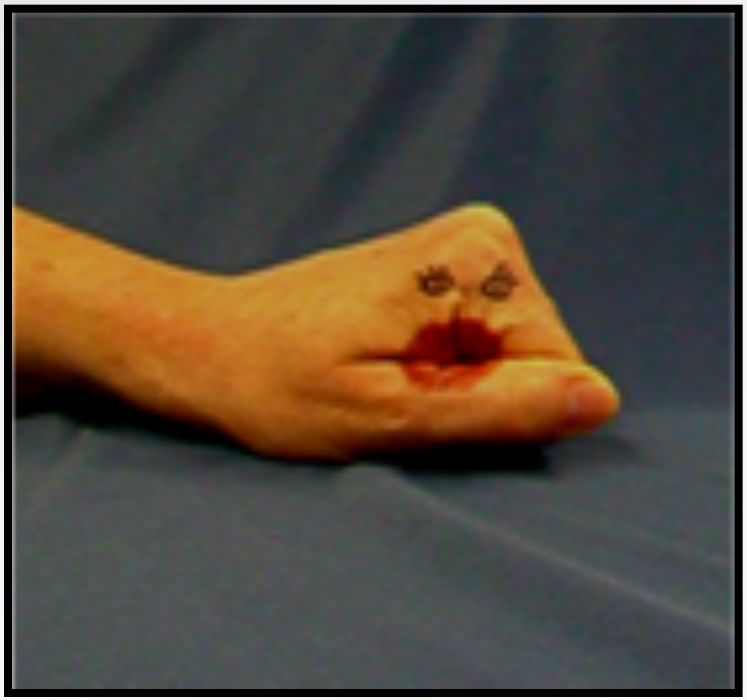
- Completed after adductor muscle release, before strengthening to restore muscle balance.
- Approximates joint surfaces.
- Assists in restoring normal and stable thumb biomechanics and arthrokinematics.
- Must be done pain free!!!

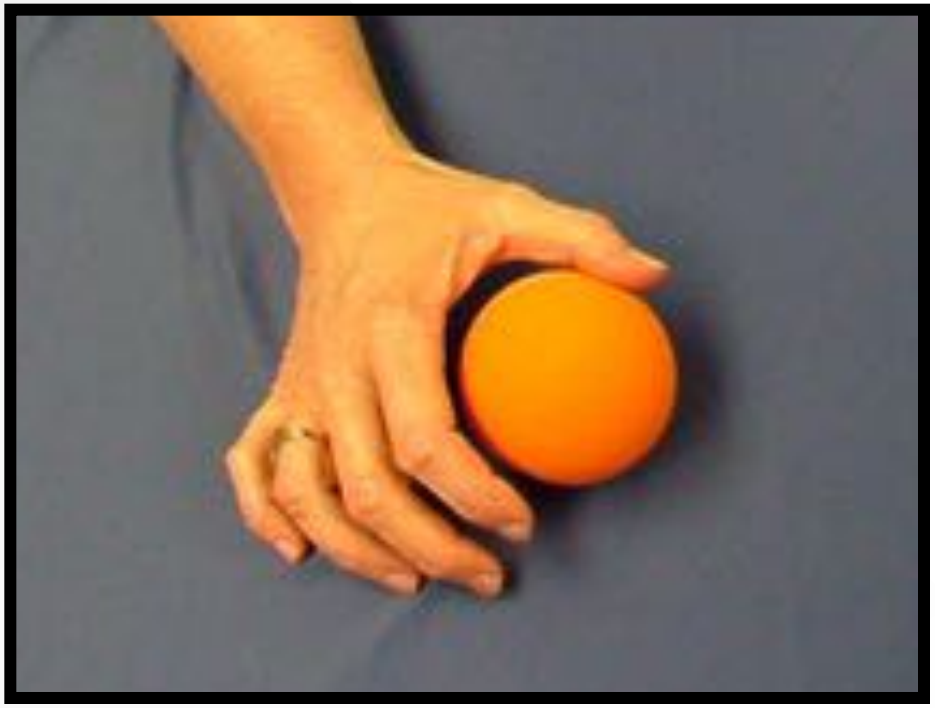


# Muscle re-education

- Re-education of the thumb muscles to restore stable balance
- Focus:
  - Abductor pollicis brevis and Opponens Pollicis
  - 1st Dorsal Interrosseous
  - APB and Abductor Pollicis Longus
  - Retrain Thumb to Stable C position for Function

# ISOLATE Abductor & Opponens

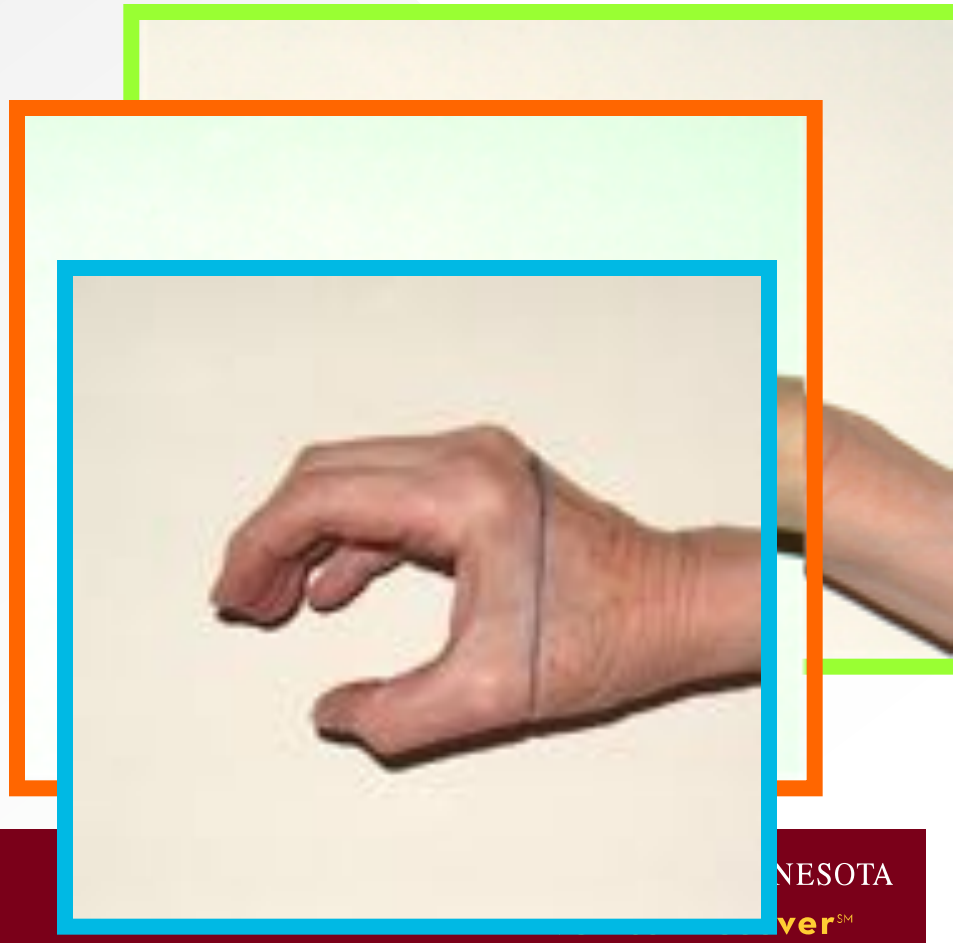




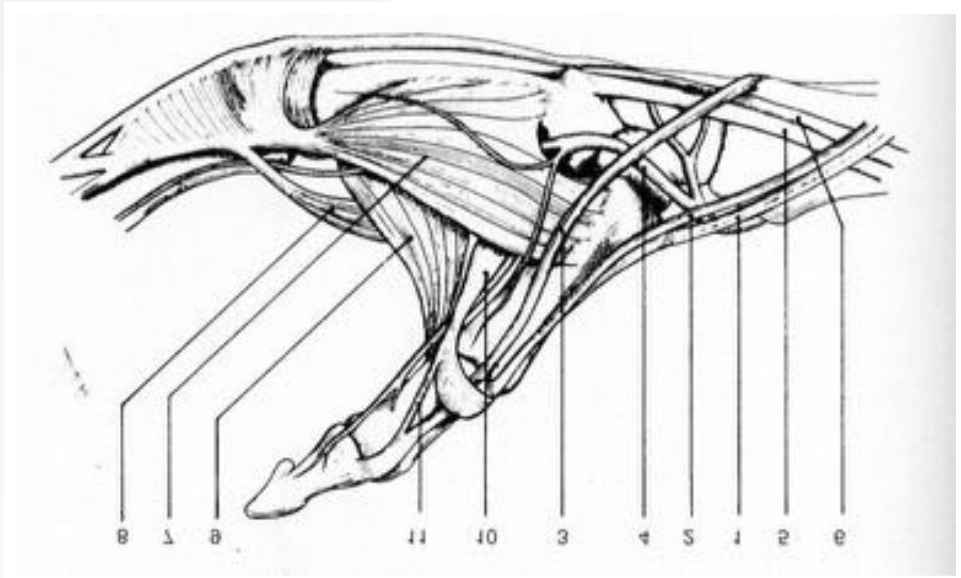
***Make the thumb puppet sing***

# 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



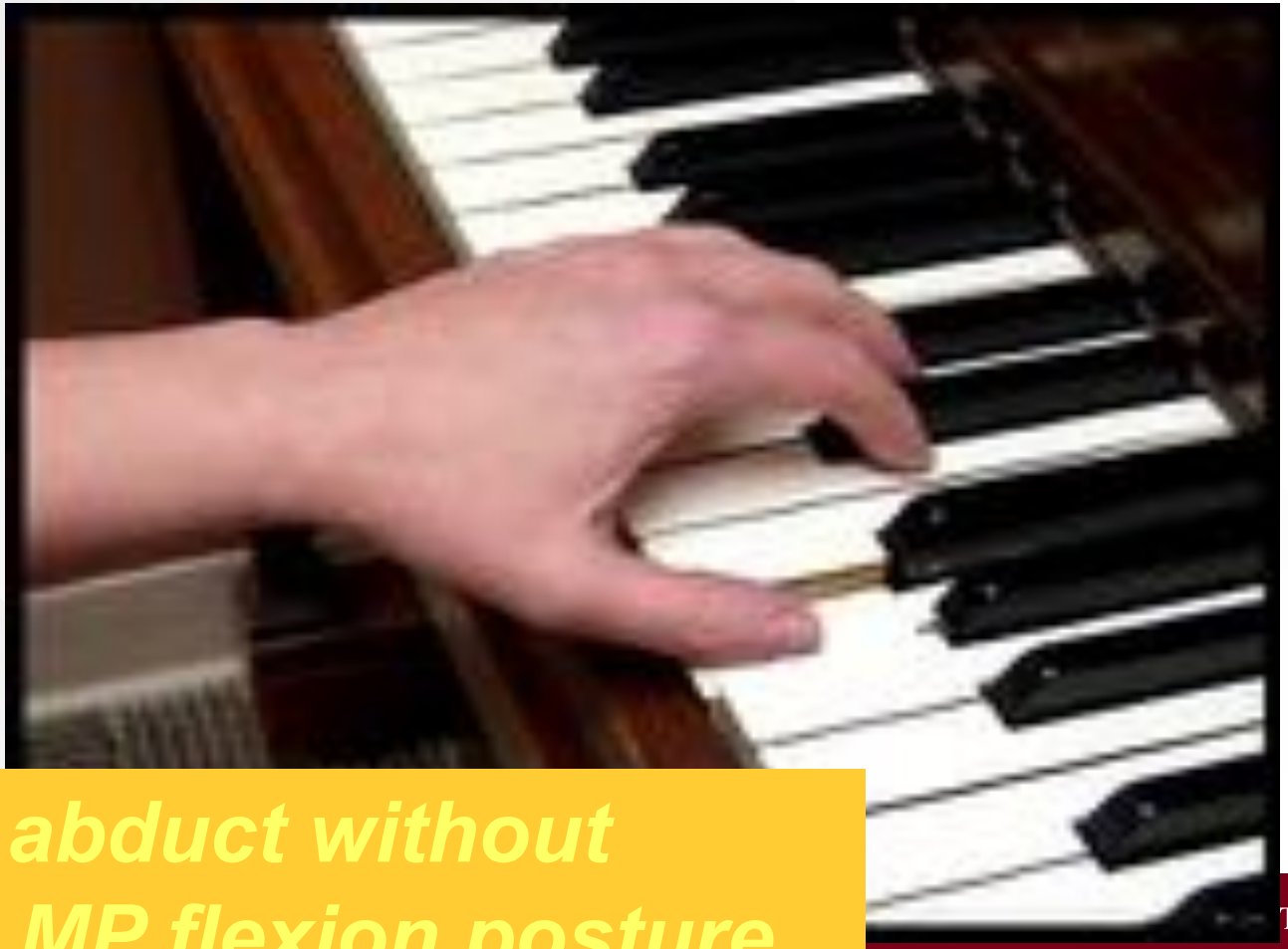
# 1st Dorsal Interosseous Exercise

***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

**Julie Adams, MD, Sara Van Nortwick, MD, Corey McGee, MS, OTR/L, CHT , Virginia O'Brien, OTD, OTR/L, CHT, Ann Van Heest, MD**

- University of Minnesota, Department of Orthopaedic Surgery
- University of Minnesota, Occupational Therapy

# Background

- Correlation between ligamentous laxity and thumb CMC OA (Jonsonn 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 1st metacarpal relative to the trapezium

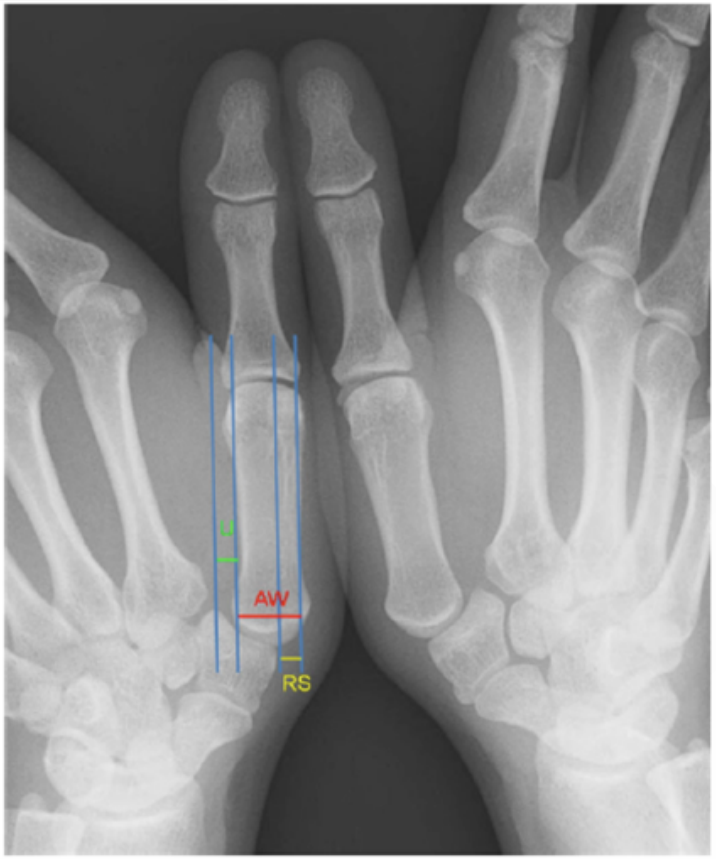
# Methods

- 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)

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



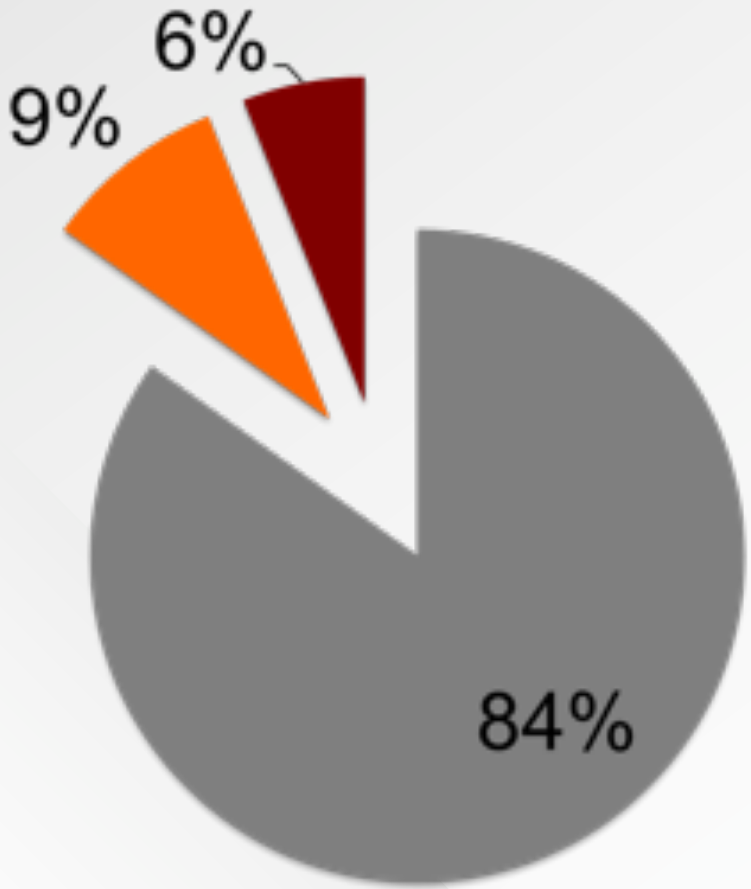

Wolf 2009

# 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

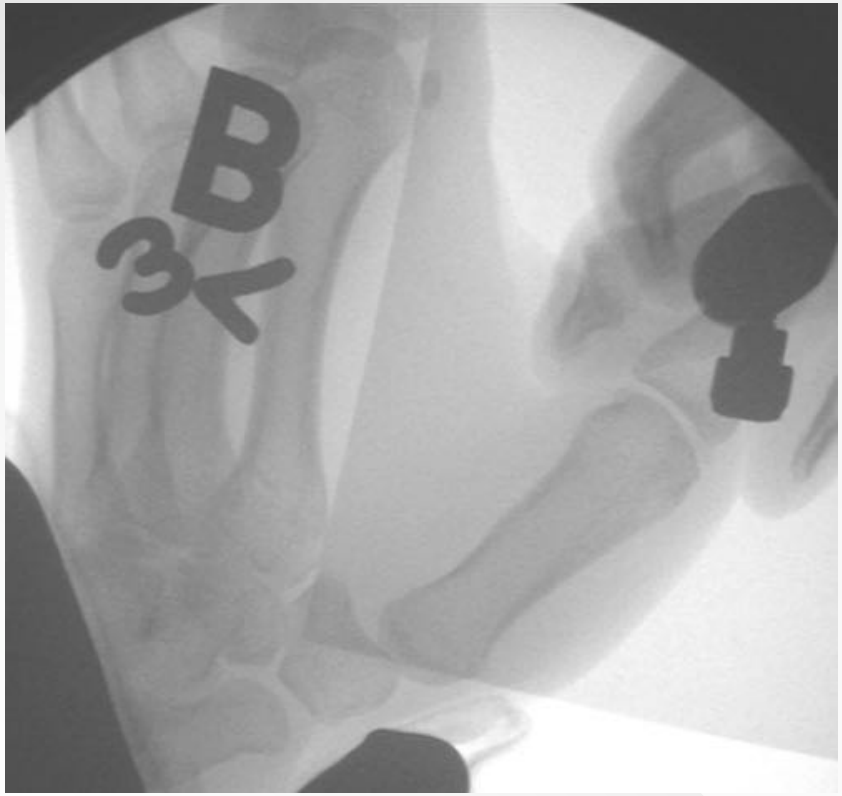


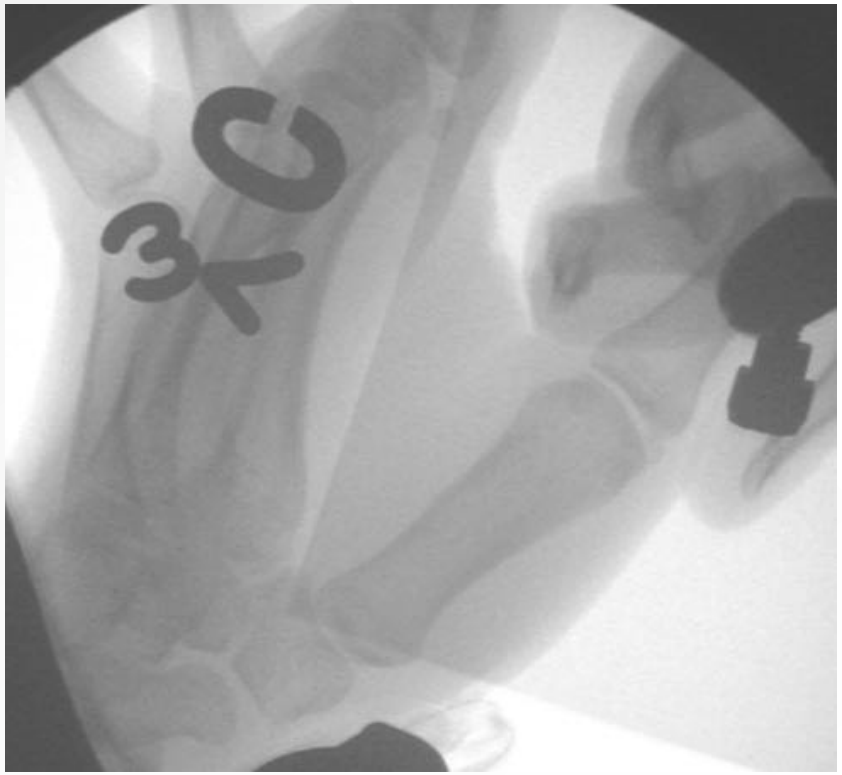

**ICC > 0.74**

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

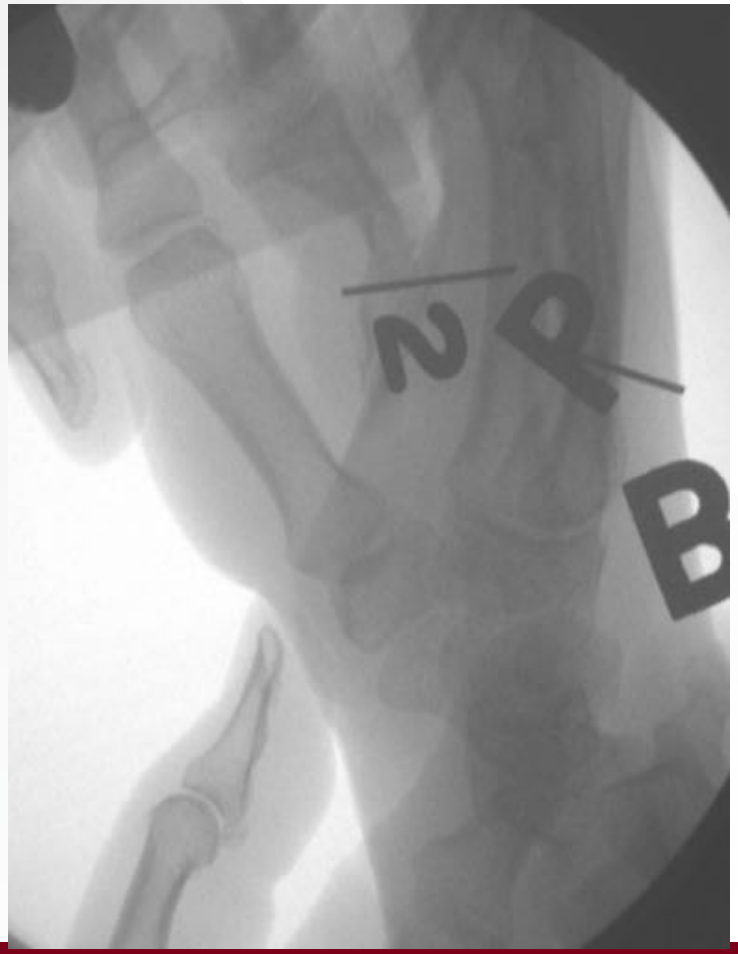
# Subluxation with Stress, Reduction with Activation of FDI (27 of 32)

- 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



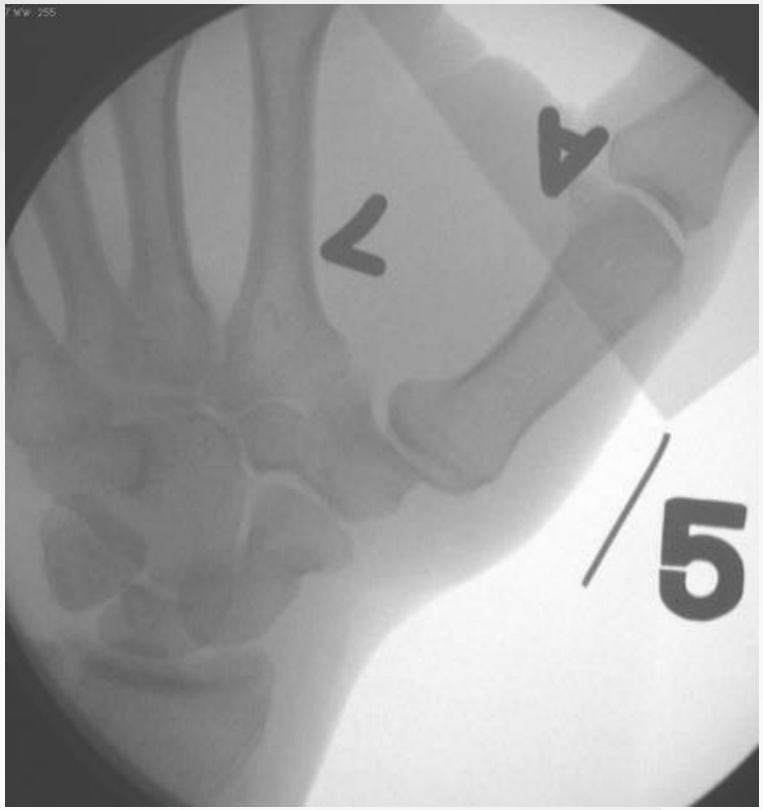



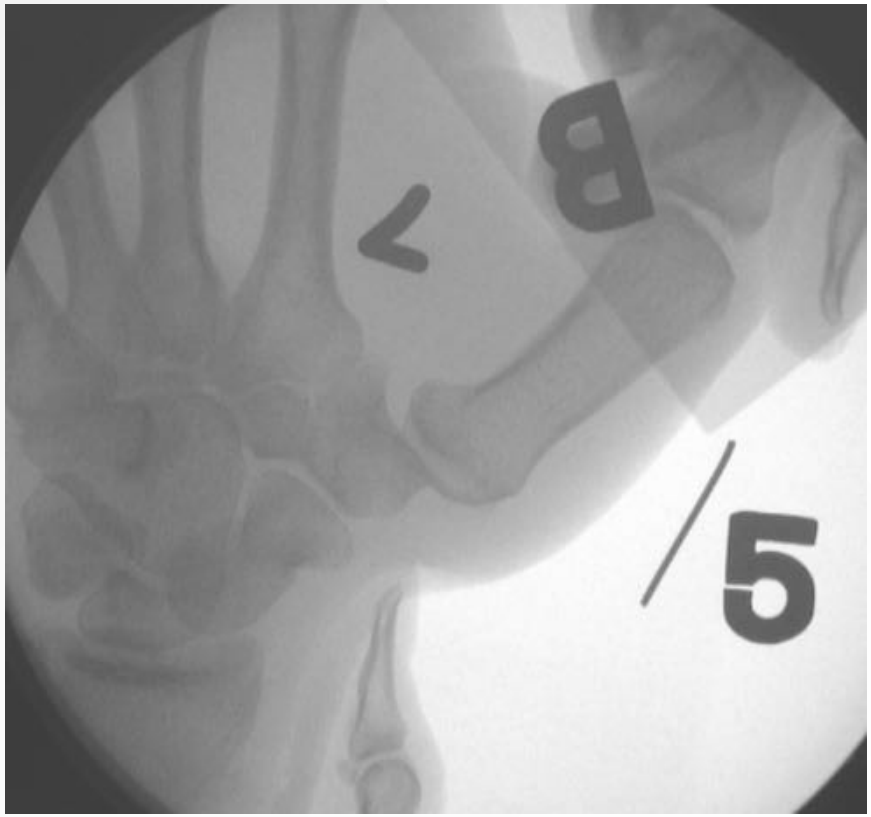
# No Subluxation at Rest or with Stress(3 of 32)

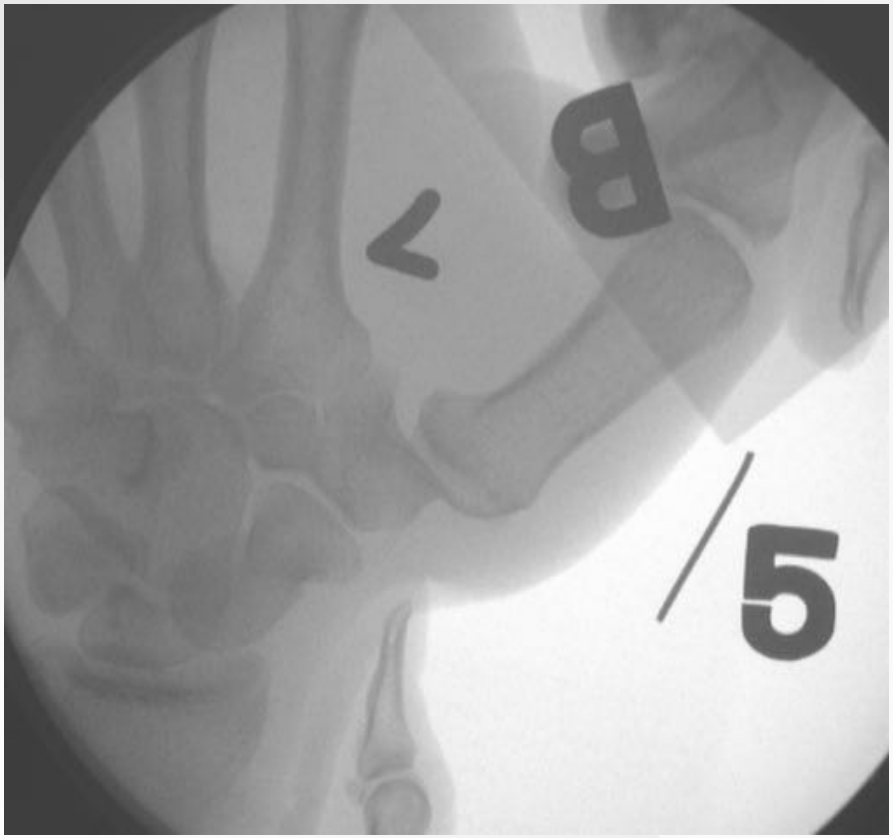
# Subluxation at Rest, No Further Subluxation with Stress (2 of 32)

- 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%)

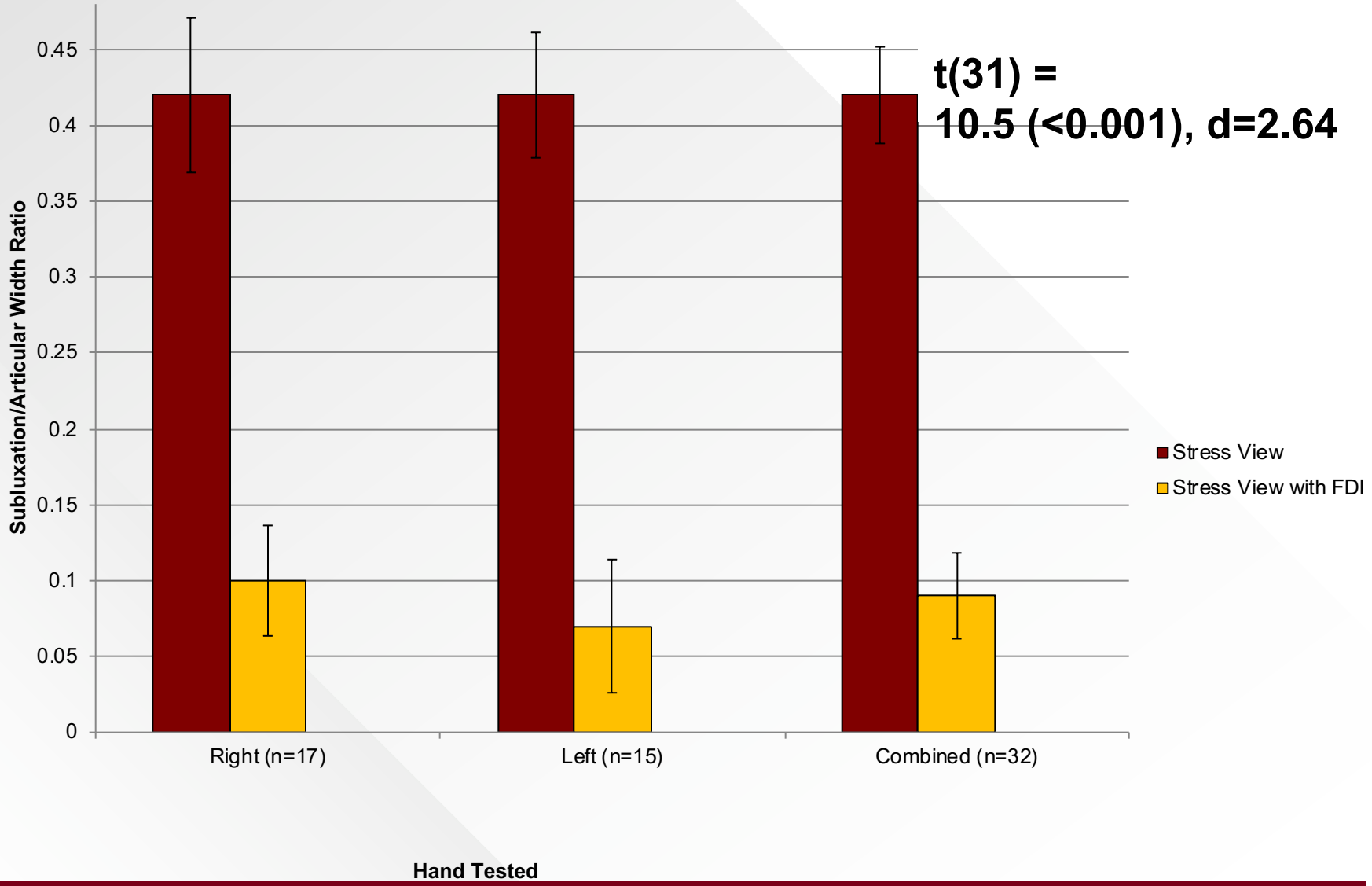




# Partial Reduction with FDI Activation



# Subluxation/Articular Width Ratio with Stress +/- FDI



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

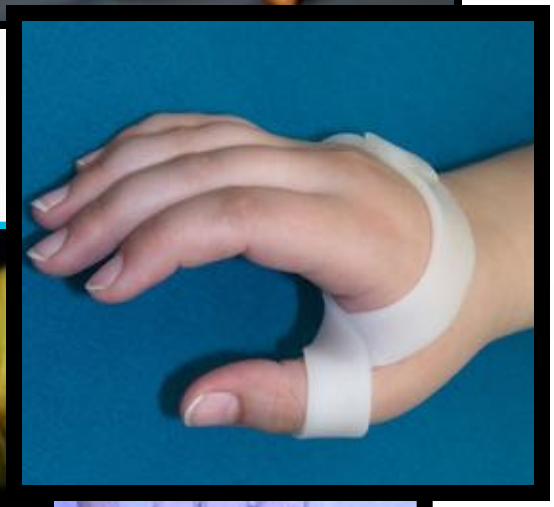
***Have key adaptive tools available in clinic***

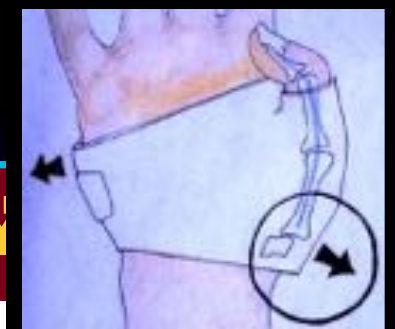
# Try out tools…..

## 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

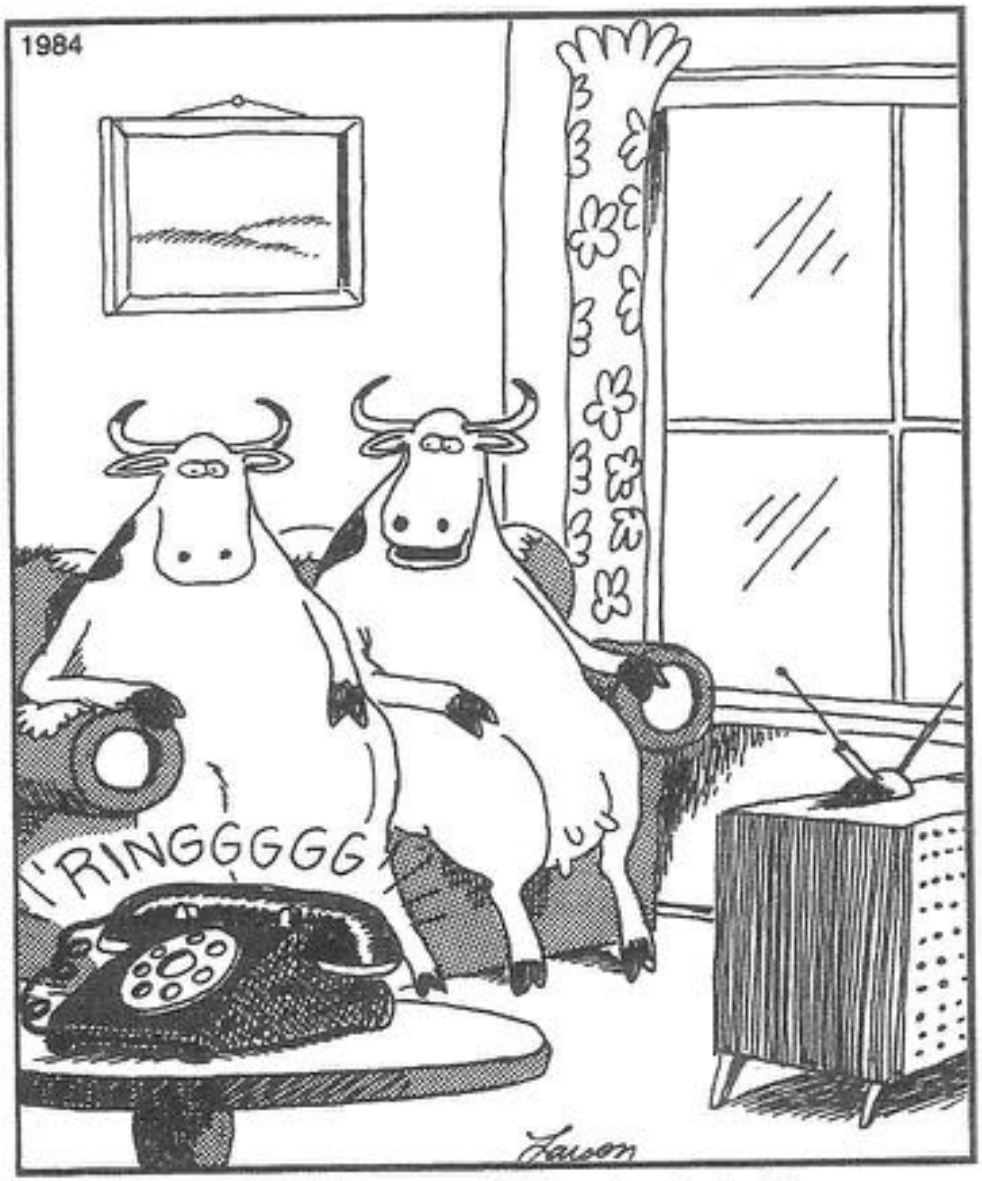
# "Resting" splints, "Prefabricated"

**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 f




"Well, there it goes again…and we just sit here without opposable thumbs."

# *THANK YOU FOR YOUR TIME AND ATTENTION*

***Ann Van Heest MD***

***vanhe003@umn.edu***