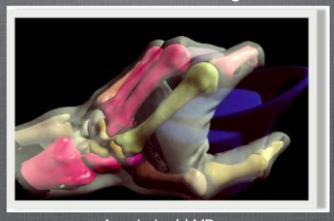
Ruth Jackson Orthopaedic Society presents

The Little Joint with Big Problems
Anatomy, Treatment, and Challenges in CMC Arthritis



Amy L. Ladd MD

Professor & Chief, Chase Hand Center
Department of Orthopaedic Surgery
Assistant Dean, Stanford School of Medicine

Disclosures

- Related
  - Funding
    - NIH RO1 2011-16
    - NIH SBIR 1,2 2005-08, 2009-11
    - OREF/RJOS/DePuy 2010
  - Royalties & Stock options- Extremity Medical, Articulinx
- Unrelated
  - Royalties - OrthoHelix
  - Stock, stock options - OsteoSpring, Illuminoss
  - RJOS President 2013-14
  - Assistant Dean of Medical Advising

Overview of Webinar

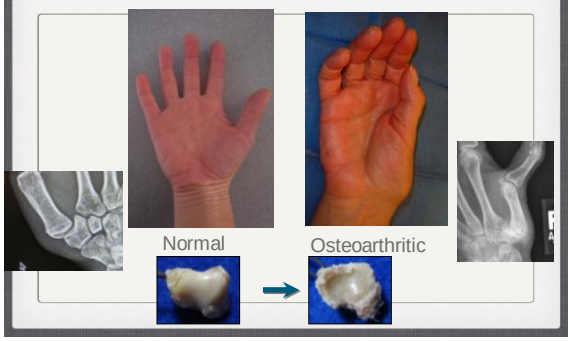
Current, clinically relevant information on CMC arthritis:

- *Why is it such a problem? – Ladd*
- *Trapeziectomy and various approaches – Weiss*
- *Less invasive procedures – Kakar*
- *Role of instability - Wolf*

Introduction

- Why is thumb CMC arthritis such a problem?
  - *Anatomy review*
  - *Treatment – consensus and lack of consensus*
  - *Challenges in treatment and prevention*

How does this joint wear out?



Anatomy – its not simple

Shape

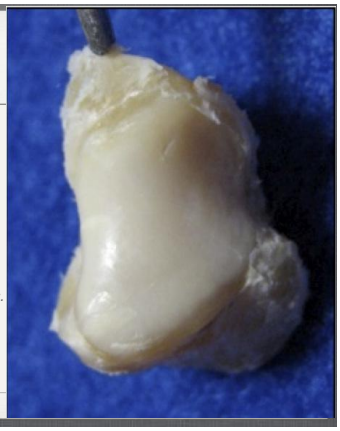
Load

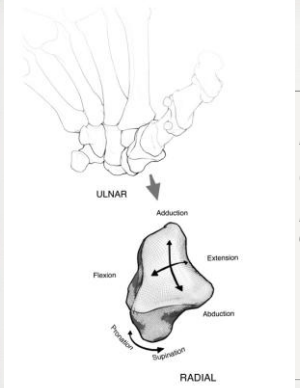
Movement

Morphology

Trapezium

The joint surfaces are eccentric.





Eccentric shape

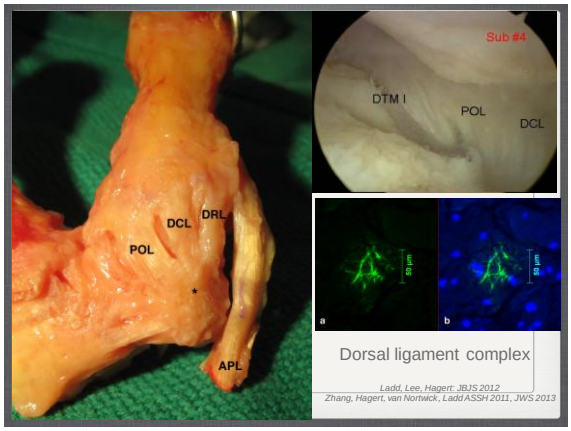
Out of plane from fingers

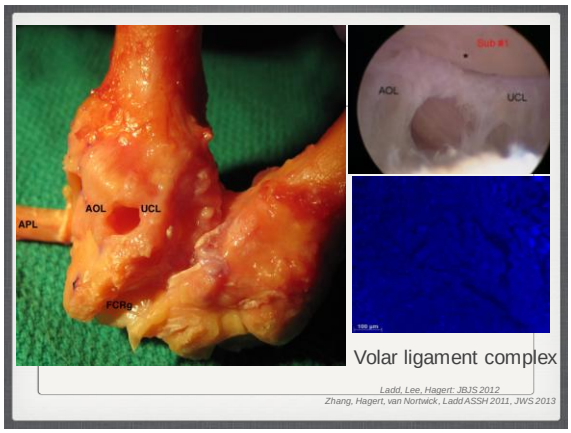
Both permit rotation and opposition

Ligament stability

Stability is part structure and part proprioception.

Ligaments may only contribute part of stability.





Load

Articular and trabecular wear patterns infer biomechanical loading.

Abnormal loading may contribute to patterns of arthritis.

Clinical examples of wear patterns

Trapezial wear patterns

36 specimens

- 27 Female (75%)
- 9 male (25%)
- age 64 (33-76)

Saddle 47%

Dish 33%

Cirque 19%

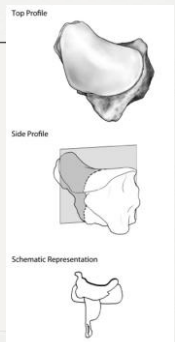
- Intra-rater reliability 0.97
- Inter-rater reliability 0.95

Van Nortwick, Berger, Cheng, Lee, Ladd: J Wrist Surgery 2013

1- Retained saddle

- Retains concavo-convex surface
- Partial eburnation
- Few osteophytes

47%



Van Nortwick, Berger, Cheng, Lee, Ladd: J Wrist Surgery 2013

2-Dish shape

A mortar and pestle
- *Trapezium = mortar*
- *Metacarpal = pestle*

•Full eburnation

•Rimming osteophytes

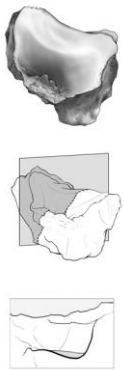
33%

Van Nortwick, Berger, Cheng, Lee, Ladd: J Wrist Surgery 2013

3-Cirque

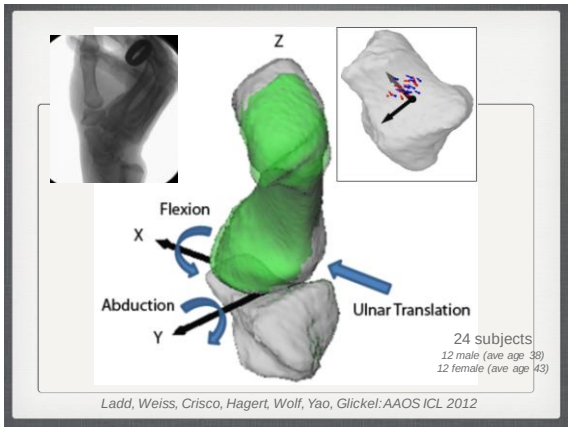
- Volar eroded concave facet
- Retained convexity dorsally
- - half a saddle

19%



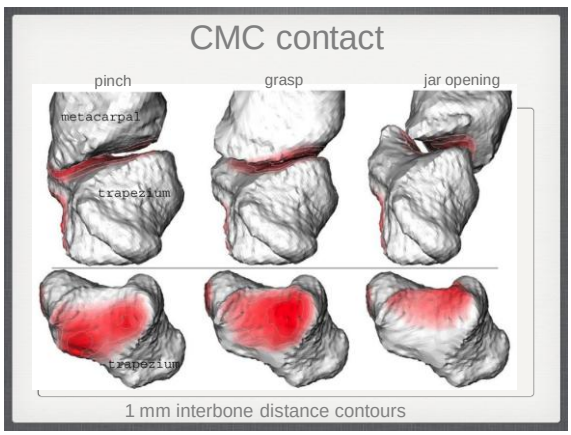
Movement

Understanding micro-motion in normal and arthritic populations suggest better ways to predict and treat arthritis.



Ladd, Weiss, Crisco, Hagert, Wolf, Yao, Glickel: AAOS ICL 2012

CMC contact



1 mm interbone distance contours

Putting it together

Treatment Dilemmas

CMC end-stage disease

- Treatment stuck in the 1950s
  - *Lessons to be learned from the big joints!*

http://www.orthobullets.com/upload/5034/images/xray%20ap%20hip%20arthrodesis.jpg

Can we do better than this?

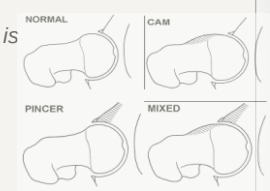
The role of the MP joint

Challenges

Where else can we find clues?

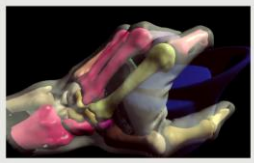
As in other joints, what is the role of:

- Instability - imbalance
- Impingement
- Proprioception



Summary - Ultimate goal

- Apply what we know about anatomy and disease
- Decipher the paradox of mobility and stability
- Use this to predict, prevent, and treat thumb arthritis



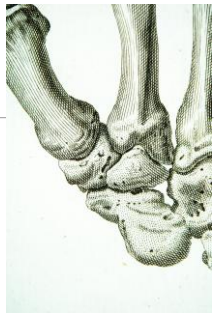
Thank you

Thumb CMC Arthroplasty

Suture Suspension Technique

Arnold-Peter C. Weiss, M.D.
R. Scot Sellers Scholar of Hand Surgery
Professor of Orthopaedics

BROWN
Alpert Medical School



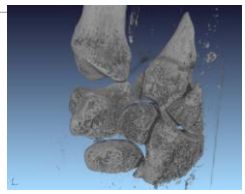
Disclosure

None

Why should I care?

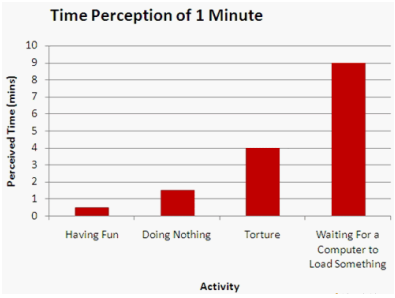
Most studies show equal outcomes
  Gerwin, Kriegs-Au, Davis
Third most common joint requiring surgery
Most common reconstructive hand surgery

BUT…
- ***Surgical times can differ***
- ***Eliminating K-wire***
- ***Cost factors***



Surgical Factors to Consider

- Time of procedure: Less is better



Surgical Factors to Consider

- Eliminating K-wire: Less discomfort post-op
- Possibility of collapse: Longer term issue
- Cost: Lower is better
- Tendon: Do we really need it?

Study Question

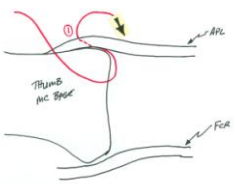
- Standard complete trapeziectomy
- Suspend by a "weave" of #2 Fiberwire between the APL and FCR at their distal most insertions
- No tendon graft
- Casted for 4 weeks
- Standard post-op hand therapy protocol

Suture Suspension Technique (n=65)

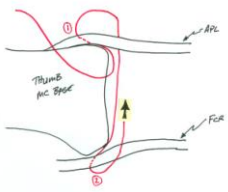
- Complete trapeziectomy

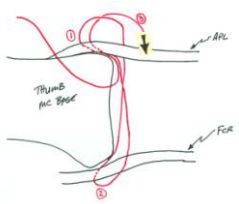

Suture Suspension Technique (n=65)

- #2 Fiberwire through distal APL insertion then through distal FCR then back through APL and once more through FCR

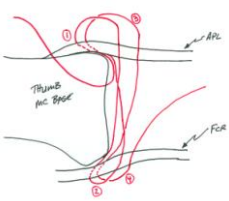



Suture Suspension Technique (n=65)



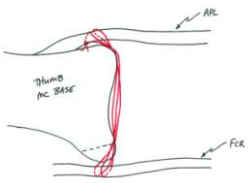


Suture Suspension Technique (n=65)

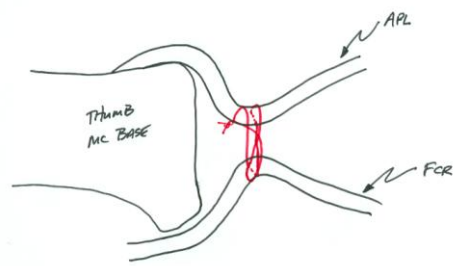


Suture Suspension Technique (n=65)

- Tie the suture ends and test longitudinal stability



NO – don't tether the two tendons



Results

- Minimum of 2 year follow-up examination
- Age: 51.3 yrs
- Average OR time = 23 minutes
- No radiographic collapse in any patient
- Pinch & grip strength plateau at 4 months
- Pain: VAS score of 0.2 (0 – 10) at final F/U exam

Discussion

- Clinical results and outcomes equal to other reported techniques
- Shortened operative time; Inexpensive
- Intrinsic & immediate stability
- A viable alternative to time intensive techniques
- Data is preliminary but promising

Thank You

"Minimally" Invasive Options & Role of Tightrope in the Management of Basilar Thumb Arthritis

Sanj Kakar MD, MRCS
Associate Professor of Orthopaedic Surgery
Mayo Clinic, Rochester

Disclosures

- Basic Science Research Grants
  - ASSH
  - Mayo Foundation
- Consulting
  - Arthrex
  - Skeletal Dynamics

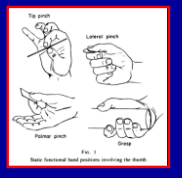
No financial relationship with Tightrope

Anatomy of 1st CMC Jt

- Biconcave saddle shaped joint
- Little osseous stability
- Semi-constrained, relatively incongruent
- Motion:
  - Flex-extension
  - Abduction-adduction
  - Rotation

Forces to Consider

- Forces across TM joint
  - Simple pinch
    - 12 kg force
  - Strong grasp
    - 120 kg force
    - Important consideration especially in a young patient



Cooney WP. *JBJS* 1977

Ideal surgical procedure for 1st CMC arthritis

- Pain relief
- CMC motion / position
  - MP joint (hyperextension)
- Pinch and grip strength
- Minimal complications
- Reproducible
- Long lasting

Treatment: Operative

- Trapezial resection alone
- Trapeziectomy & suspension
- Arthrodesis
- Implant arthroplasty
  - Altering normal anatomy & mechanical function
    - ↓ span of hand & dexterity with fine manipulation (fusion)
  - Prolonged recovery
  - What's the salvage when they fail ?

e.g. young pt, manual labourer

Are there minimally invasive treatment options?

Can we maintain the trapezium?

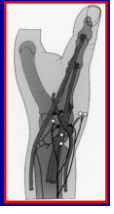
MAYO CLINIC

Denervation of CMC Joint

MAYO CLINIC

Proposed Advantages

- Pain relief
  - Without compromise of ROM & strength
- Minimal rehabilitation
- Doesn't burn bridges for future tx



MAYO CLINIC

Innervation of Thumb CMC Jt

- **SBRN**
  1. dorso-radial collateral of thumb
  2. Lejar's branch
  3. dorso-ulnar collateral of thumb
  4. dorso-radial collateral of index
  5. Anastomoses between 3 & 4
- **LABCN**
  - Cruveilhier's branch
- **Median nerve**
  - Thenar branch
  - Palmar cutaneous nerve
- **Branch of deep motor ulnar nerve**

MAYO CLINIC

Innervation Pattern Highly Variable

DeMooj, Berger & Kakar 2014 (in works)

Table 1 - Innervation Patterns of the Trapezio-Metacarpal Joint

Author	Cozzi	Loréa et al	Poupon et al	Miki et al
Year	1991	2002	2004	2011
Limbs	500	10	15	19
Right side	-	-	8	10
Male	-	-	-	7
Posterior Interosseous Nerve	-	0	-	-
Sup. Rad. N. not otherwise specified	100%	10 (100%)	15 (100%)	11 (58%)
Dorso-radial collateral of the thumb	70%	+	15 (100%)	-
Dorso-ulnar collateral of the thumb	+	+	3 (20%)	-
Dorso-radial collateral of the first finger	+	+	1 (7%)	-
Lejars branch	30%	-	14 (93%)	-
Dorsal articular nerve of Winckler's first interosseous space	-	**9 (90%)	***3 (20%)	-
Lateral Antebrachial Nerve	-	+	-	-
Cruveilhier's branch	-	10 (100%)	-	-
Anterior Interosseous Nerve	-	0	-	-
Palmar Cutaneous branch	* - (5%)	9 (90%)	11 (73%)	0
Thenar Branch Median branch	* - (5%)	9 (90%)	13 (87%)	9 (47%)
Intra-canal branch of thenar branch	-	2 (20%)	5 (30%)	-
Motor Branch of Ulnar Nerve	-	0	-	9 (47%)

-: did not look at this nerve or branch
+: looked at this nerve or branch, but did not note a number of articulation branches
0: looked at this nerve or branch, but did not find any articulating branches

* estimation by author
** originated from dorso–ulnar digital nerve of the thumb in 2, dorso-radial digital nerve of the index finger in 3 and for the bifurcation between these branches in 4
*** derived from dorso-radial collateral of the first finger

Techniques in Hand and Upper Extremity Surgery 7(1):24–31, 2003 © 2003 Lippincott Williams & Wilkins, Inc., Philadelphia

TECHNIQUE

First Carpometacarpal Joint Denervation: Anatomy and Surgical Technique

PATRICK D. LORÉA, M.D.

- **Two incisions** (palmar & dorsal)
- **Denervated**
  - Superficial Radial Nerve
  - Lateral Antebrachial Nerve
  - Palmar Cutaneous Branch of Median Nerve
  - Thenar Branch of Median Nerve
- **43 pts (mean age: 60 yrs [range 30-77])**
  - 3 heavy manual labour & 2 factory workers
- **Improved rest pain (90%) > ADL (86%) > heavy work (82%)**
  - ↑ Kapandji score & key pinch
  - 42/43 pts were satisfied
- **No charcot joint**

Wagner Approach for First Carpometacarpal Joint Denervation

Joan M. Arenas-Prat, MD*†

- Wagner approach — Tech Hand & Upper Extrem Surg 2012
- Denervated
  - Superficial Radial Nerve
  - Lateral Antebrachial Nerve
  - Palmar Cutaneous Branch of Median Nerve
  - Thenar Branch of Median Nerve
- 16 pts (18 thumbs)
  - 14/16 pts → satisfied or very satisfied
  - NO formal pain assessment/?degree of arthritis
- Complications: 2 pts → painful HT scar

1 pt → hypoaesthesia over dorsum thumb

Thumb Metacarpal Osteotomy

MAYO CLINIC

Ligament Laxity Theory of Thumb Arthritis

- Volar beak ligament degenerates & detaches
- Abnormal shear stresses across anterior compartment of joint causes CMC arthritis
  - *Degeneration of palmar metacarpal cartilage*
  - Exacerbated by pinching (flexion & adduction of 1st metacarpal)
- Extension osteotomy of 1st metacarpal — Pelligrini VD Jr. et al
  - Palmar contact unloaded & contact pressure moved dorsally
  - Indications: Eaton stage 1 disease

MAYO CLINIC

Pelligrini VD Jr. et al J Hand Surg, 1991;16A:967-974

Pelligrini VD Jr. et al J Hand Surg, 1996;21A:16-23

Treatment of Eaton Stage I Trapeziometacarpal Disease With Thumb Metacarpal Extension Osteotomy

Matthew M. Tomaino, MD, *Pittsburgh, PA*

- Prospective study (12 pts, Eaton stage 1)
  - Average f/up 2.1 yrs
- 30^0 metacarpal extension osteotomy
- Results
  - Union at 7 wks
  - 11/12 pts satisfied
    - ↑ grip & pinch strength
    - All pts returned to work

MAYO CLINIC

Long-Term Outcomes of First Metacarpal Extension Osteotomy in the Treatment of Carpal-Metacarpal Osteoarthritis

Wendy L. Parker, MD, PhD, Ronald L. Linscheid, MD, Peter C. Amadio, MD

- 8 pts (3 Eaton stage 1, 3 Eaton stage 2 & 2 Eaton stage 3)
  - Average f/up 9 yrs
- Results
  - ↑ grip strength (108% of contralateral side)
  - ↑ appositional pinch strength (129%)
  - ↑ oppositional pinch strength (103%)
  - 6/8 pts → excellent functional outcomes
  - Eaton stage preserved 5/8 pts

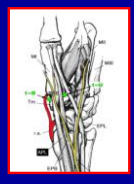
MAYO CLINIC

Arthroscopic Treatment

MAYO CLINIC

Arthroscopy for CMC OA

- Technique - Berger, *JHS*, 1997
  - Portals (locate with 18 g needle +/- fluoro)
    - 1R (radial to APL at CMC jt)
    - 1U (ulnar to EPB at CMC jt)
      - Dangers
        - SBRN, radial artery
  - Equipment
    - Thumb in txn (5-10lbs)
    - Insufflate jt (2mls 1U portal)
    - 1.9mm short barrel scope
    - 2mm shaver through 1R to debride synovitis (use 2.9mm burr once space ↑ within a 3.5mm sheath to prevent clogging during trapeziectomy)



MAYO CLINIC

Thumb Carpometacarpal Arthroscopy: A Topographic, Anatomic Study of the Thenar Portal

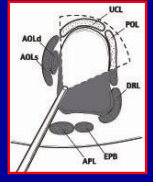
Eric F. Walsh, MD, Edward Akelman, MD, Braden C. Fleming, PhD, Manuel F. DaSilva, MD, *Providence, RI*

- Replace 1R with thenar portal
  - Arthroscope in 1U portal
  - Thenar portal 90⁰ to 1U portal
- Results (thenar portal)
  - Good working portal
  - ↓ sword fighting
  - Didn't violate the dAOL
    - Further away from sensory nerves than 1R
    - 23mm away from recurrent motor branch median nerve

MAYO CLINIC

Advantages of CMC Arthroscopy Menon 1996

- ↓ invasion compared to open approach
- ↓ postop pain & stiffness
- Quicker rehabilitation
- Doesn't burn any bridges

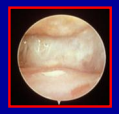


MAYO CLINIC

Trapeziometacarpal Arthroscopy: A Classification and Treatment Algorithm

Alejandro Badia MD, FACS

- Stage 1
  - Synovitis & ligamentous laxity
    - Synovectomy +/- thermal shrinkage
- Stage 2
  - Cartilage loss on ½ trapezium
    - Metacarpal extension osteotomy
    - Arthroscopic tx
- Stage 3
  - Diffuse cartilage loss
    - Arthroscopic hemitrapeziectomy



MAYO CLINIC

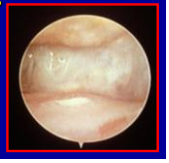
What Does The Literature Show As To Efficacy of Tx !!!

MAYO CLINIC

Arthroscopic Debridement and Synovectomy for Treating Basal Joint Arthritis

John P. Furia, M.D.

- 23 pts (Eaton stage 1 & 2)
  - Arthroscopic synovectomy & debridement & splint 1wk
  - Control grp: 21 pts non op tx
  - Evaluated 1 yr later
- Results
  - 83% surgical pts → good to exc results
  - Surgical pts:
    - ↓ pain, ↑ DASH & pinch strength
  - Complications
    - Wound infection (1)
    - DSRN irritation (1R)



MAYO CLINIC

Prospective Outcomes of Stage III Thumb Carpometacarpal Arthritis Treated With Arthroscopic Hemitrapeziectomy and Thermal Capsular Modification Without Interposition

Scott G. Edwards, MD, Peter N. Ramsey, MD

- 23 pts (Eaton stage 3)
  - Hemitrapeziectomy (3-4mm)
    - CMC jt pinned (3-4 wks)
  - >4 year follow up
- Results
  - 19/23 pts pleased with results
  - ↑ DASH & pinch & grip strength
  - Proximal migration ~ 3mm
  - Complications
    - 1 Wound infection
    - 1 DSRN irritation (1R)
    - 1 pt → LRTI

MAYO CLINIC

Arthroscopic Hemitrapeziectomy With Tendon Interposition for Arthritis at the First Carpometacarpal Joint

Brandon E. Earp, MD, Albert C. Leung, MD, Philip E. Blazar, MD, and Barry P. Simmons, MD

- 14 pts (Eaton 2 & 3)
  - Hemitrapeziectomy & interposition (PL, FCR)
  - F/up: 11 months (3.3-17.3)
- Results
  - VAS ↓8.6→ 1.8 (p<0.005)
  - 90% restoration grip & pinch strength
  - 10/11 pts → "much better"
  - Complications
    - 1 CRPS
    - ? 1Graft extrusion

J Hand Surg Eur Vol. 2007 Jun;32(3):268-74.

Arthroscopic interposition arthroplasty of the first carpometacarpal joint.

Adams JE, Merten SM, Steinmann SP.

Hand (N Y). 2009 Mar;4(1):24-8. doi: 10.1007/s11552-008-9134-2. Epub 2008 Sep 24.

Arthroscopic hemitrapeziectomy for first carpometacarpal arthritis: results at 7-year follow-up.

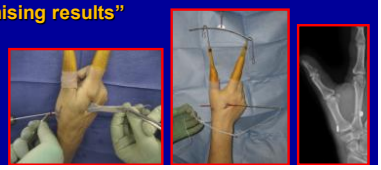
Hofmeister EP, Leak BS, Cole RW, Osterman AL.

Tightrope

Suspension Arthroplasty

MAYO CLINIC

- Suture button compared with k wire fixation for maintenance of post-trapeziectomy space Yao et al. 2010
  - Cadaveric study
  - Maintenance of suspension (lateral, cyclic, dynamic pinch)
- Suture button suspensionplasty after arthroscopic hemitrapeziectomy for thumb CMC arthritis Cox et al. 2010
  - 16 pts (Eaton II-III)
  - ROM & splint at 2 weeks
  - At 1 yr → "promising results"



MAYO CLINIC

Suture Button Suspension Arthroplasty for Thumb CMC Arthritis

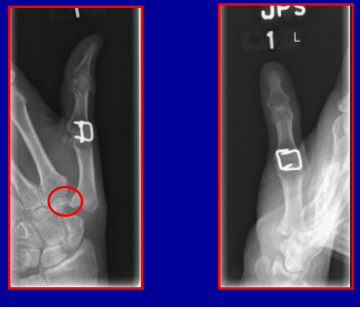
Yao & Song 2012

- 21 pts (f/up >24 M)
  - Tightrope & 2.7mm drill (8 arthro hemi & 13 open trapeziectomies)
  - ROM & splint at 10 days post op
- Results
  - All pts → full ROM
  - Quick DASH: 10 +/- 9
  - Grip & pinch strength: 86% & 89% contralateral side
  - Trapezial height → 74% of contralateral side
  - 1 CRPS & 1 frx 2nd metacarpal

MAYO CLINIC

Had experience with mini Tightrope in revision cases

- 55F 6 months post op (tx elsewhere)



MAYO CLINIC

ECRL suspension, tightrope and graft jacket interposition

- 18 months post op

My Initial Thoughts Tightrope:

- Skeptical
- Concerns of breakage

BUT gives immediate stability

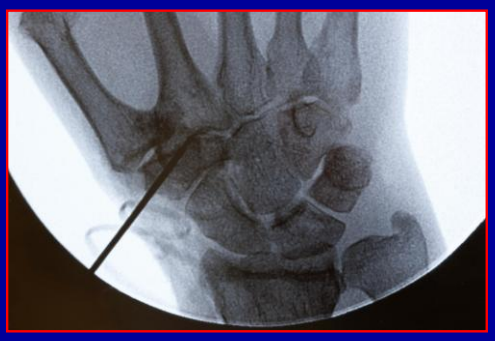
If doing a trapeziectomy and suspensionplasty:

- Tightrope

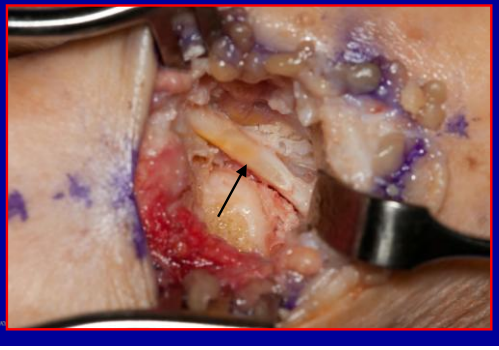
- Imbricate FCR to APL

58F CMC & STT jt involvement

- Work in plane between APL & EPB & isolate and protect radial artery

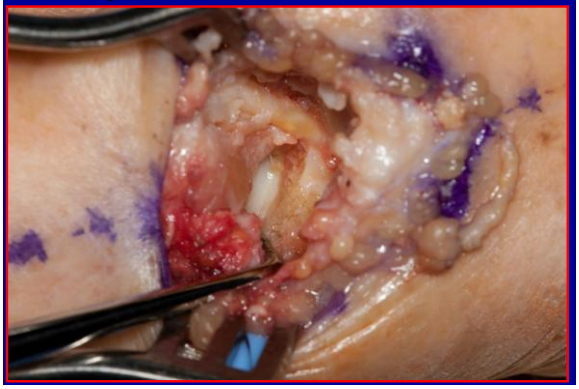


- Remove trapezium with care not to injure underlying FCR tendon!!!

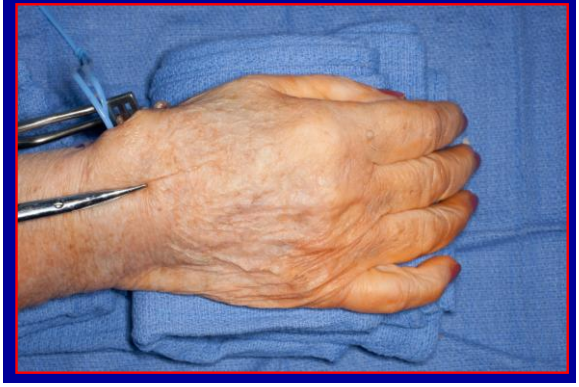


- Inspect ST joint & debride if arthritic

- ST joint debrided

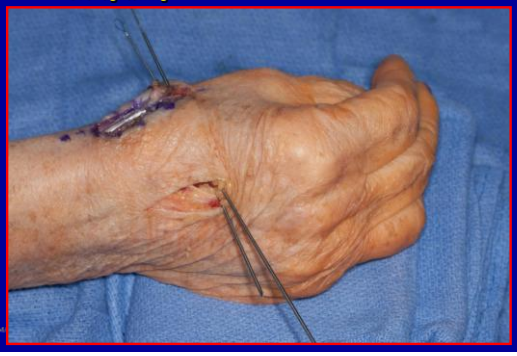


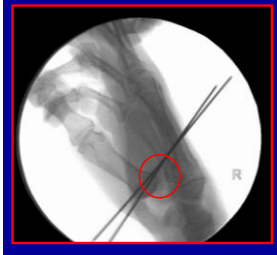
- Dorsal approach base of 2nd metacarpal

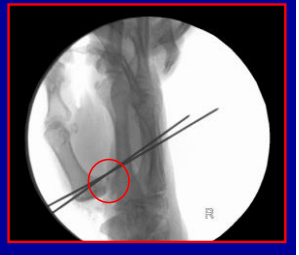


- Ensure debridement of osteophytes at base of 1st & 2nd metacarpal bases to ↓ impingement
- Free hand or with guide place k wire from base of 1st to 2nd metacarpal…..ensure you are through 4 cortices!!!!!
  - Extend 1st metacarpal base and palmar abduct when passing wire

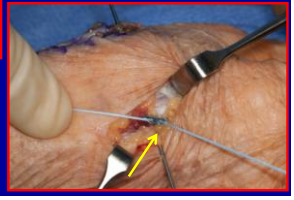
- Can place 1 or 2 wires!!!
  - Maintains space between 1-2 metacarpal bases & prevents over tightening



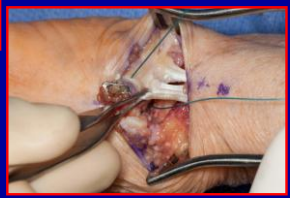




- Pull endobutton down onto 1st metacarpal and tie down 2nd button. Repeat steps for 2nd tightrope if desired
- Close periosteal flap over 2nd metacarpal to ↓ symptomatic hardware



- Imbricate FCR to APL tendon
  - Extends base 1st metacarpal
  - Belt & braces



MAYO CLINIC

Post Op Protocol

- 2 weeks thumb spica post op splint
- If comfortable, start AROM at 2 weeks (protect with thumb spica splint for 2-4 weeks)
- Grip strengthening at 6 weeks

- Apposition pinching at 12 weeks

Mayo Experience

Kakar and Parry 2014

- 11 pts (1M,10F)
  - 60yrs (43-73)
- 2 mini tightropes & FCR to APL imbrication
- Follow up 18 months (range:13-26 months)

	Preoperative (Range)	Postoperative (Range)	Difference (95% CI)	P value
Grip Strength (kg)	12.6 (2-28)	24.4 (12-40)	11.7 (8.8 to 14.6)	<0.0001*
Appositional Pinch (kg)	4 (1-7)	6.4 (4-10)	2.5 (1.4 to 3.5)	<0.0004*
Oppositional Pinch (kg)	3.6 (0.5-9)	6 (2-10)	2.6 (1.2 to 4)	<0.0021*
MCP Hyperextension	14 (0-30)	9.1 (0-20)	- 8 (-18.4 to 2.4)	<0.1
MCP Flexion	54.5 (40-70)	50.6 (30-60)	-4.3 (-20 to 11.3)	<0.5
IP Hyperextension	10.4 (0-30)	11.4 (10-15)	-0.7 (-12.4 to 11)	<0.88
IP Flexion	64 (40-80)	65.7 (45-80)	3.5 (-4.7 to 11.8)	<0.1

MAYO CLINIC

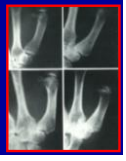
Mayo Experience

Kakar and Parry 2013

- Post operative outcome questionnaires:
  - DASH 19
  - MHQ 75
  - PRWE 21
- Radiographs:
  - Maintenance of trapezial space
- Complications:
  - 1 CRPS
  - 3 DSRN irritation (resolved)

MAYO CLINIC

Summary



MAYO CLINIC

- Minimally invasive procedures have a role in management of thumb CMC OA
  - Young pts
  - Manual labourers
- Maintain the length of thumb (power)
- Denervation procedures
  - Minimal morbidity without burning bridges

MAYO CLINIC

- Arthroscopy
  - Similar results to open tx
  - No PRCT compared to open tx
  - Eaton 1:
    - Debridement & synovectomy
    - Metacarpal extension osteotomy
  - Eaton 2-3:
    - Hemitrapeziectomy +/- interposition +/- tightrope
  - Eaton 4:
    - Trapeziectomy +/- tightrope

Thank You For Your Attention

Email:
Kakar.sanjeev@mayo.edu

VuMEDI: Why Do Men Get Thumb CMC Arthritis?

Jennifer Moriatis Wolf, MD
Associate Professor
Department of Orthopedic Surgery
University of Connecticut
UConn Health Center

Disclosures

- Grant Funding – AFSH, OREF, University of Connecticut
- Salary – Deputy Editor of Journal of Hand Surgery, Elsevier Updates Editor

Overview

- Epidemiology
- Sex Differences

Epidemiology

- Incidence of thumb CMC OA increases with increasing age in both sexes
- Women >> Men
  - Radiographic
  - Clinical

Radiographic Differences

- Haara et al – large Finnish population study
  - Incidence of Kellgren-Lawrence grade 3/4 OA of the TM joint *JBJS-A, 2004*
    - 14.5% in women
    - 10% in men
- Sodha et al – large study of ED radiographs for fracture *JBJS-A, 2005*
  - Noted increasing rate of TM OA with age
  - In worst TM OA – 66% prevalence in women compared to 23% of men

Symptomatic Differences

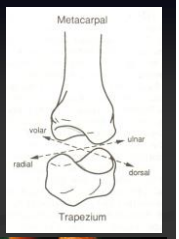
- Framingham study – prevalence in TM joint
  - 5% in women
  - 2.5% in men *Zhang et al, Am J Epidemiol, 2002*
- Physician-diagnosed TM OA in Sweden
  - Primarily captured public health system
  - Overall prevalence of 2.2% in women and 0.69% in men
  - Men diagnosed over a decade later than women
    - *Wolf et al, Arthr Care Res, 2013*

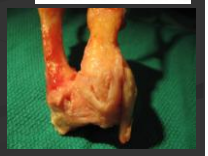
Why the Sex Difference?

- Not known
  - Anatomy
  - Biomechanics
  - Hormones
  - Occupation
  - Genetics

Anatomy

- Saddle-shaped joint
  - Stabilized by ligaments to provide mobility and stability
- Ligaments have been studied for strength
  - Best recent data indicates dorsoradial ligament (DRL) major stabilizer *Ladd, Hagert JBJS-A, 2012*
  - As opposed to thinner AOL



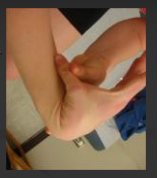


Sex Difference in Bony/ Ligamentous Anatomy

- Study in 18 female and 13 male cadavers
  - Average age 71.4 years
- Used micro-calipers to measure
  - Metacarpal width
  - Trapezial width
  - Ligament thickness
- Men had greater width of metacarpal and
  18.83 mm vs. 16.65 mm)
- Men had thicker DRL, sAOL
  - *Gerhardt, Baldini, Wolf, unpublished data*

Biomechanical Differences

- Bettinger et al – studied material properties of TM stabilizing ligaments in 10 male and 10 female cadavers
  - Ultimate load and stress of AOL significantly higher in men
  - Ultimate strain of DT-II MC ligament greater in women
    - Bettinger et al, *J Hand Surg Am*, 1994
- Role of laxity
  - Women have greater overall laxity than males
    - Larsen et al, *Arthr Rheum*, 1987
  - Possible abnormal loading playing a greater role in women



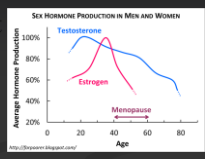
Men and TM Subluxation

- Hunter et al – Framingham study
  Osteoarth Cartilage, 2005
- 203 men and 431 women
  - Hand radiographs in 1967 and 1993
  - Evaluated for TM subluxation
- Noted that baseline TM subluxation correlated with development of later TM OA *in men* only

Occupation

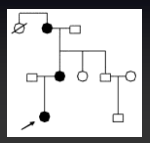
- No studies evaluating occupation directly between sexes
- Framingham study – evaluated grip strength and associated development of hand OA *Chaisson et al, Arthr Rheum, 1999*
- 453 eligible subjects over 30 years
- Highest maximal grip strength in men associated with increased risk of PIP, MCP, and thumb CMC OA
- Women's grip showed correlation with MCP OA only

Hormones



- Sex hormones attractive target
  - Estrogen
  - Progesterone
  - Testosterone
  - Relaxin
- Primary evidence in animal studies of OA
- Relaxin levels higher in post-menopausal women than age matched men *Wolf et al, J Hand Surg Am, 2013*
- Further studies ongoing

Genetics



- Multiple studies have shown genetic component in hand OA in general
  - Ishimori et al showed osteophyte distribution to be genetically linked Arthr Res Ther, 2010
- Mutations in matrilin-3 (ECM protein gene) linked to more severe form of TM OA
  - Eliasson et al, Scand J Rheumatol, 2006

Conclusions

- Men with TM OA
  - Present later than women
  - Possibly different mechanism
    - ?more direct joint load vs. ligament attenuation
- Anatomic differences in men and women
- Interaction between anatomy, genetics, and environment may be different in men

THANK YOU