

Hand Arthritis: Biologics and Beyond

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Faculty / Presenter Disclosure

Faculty:

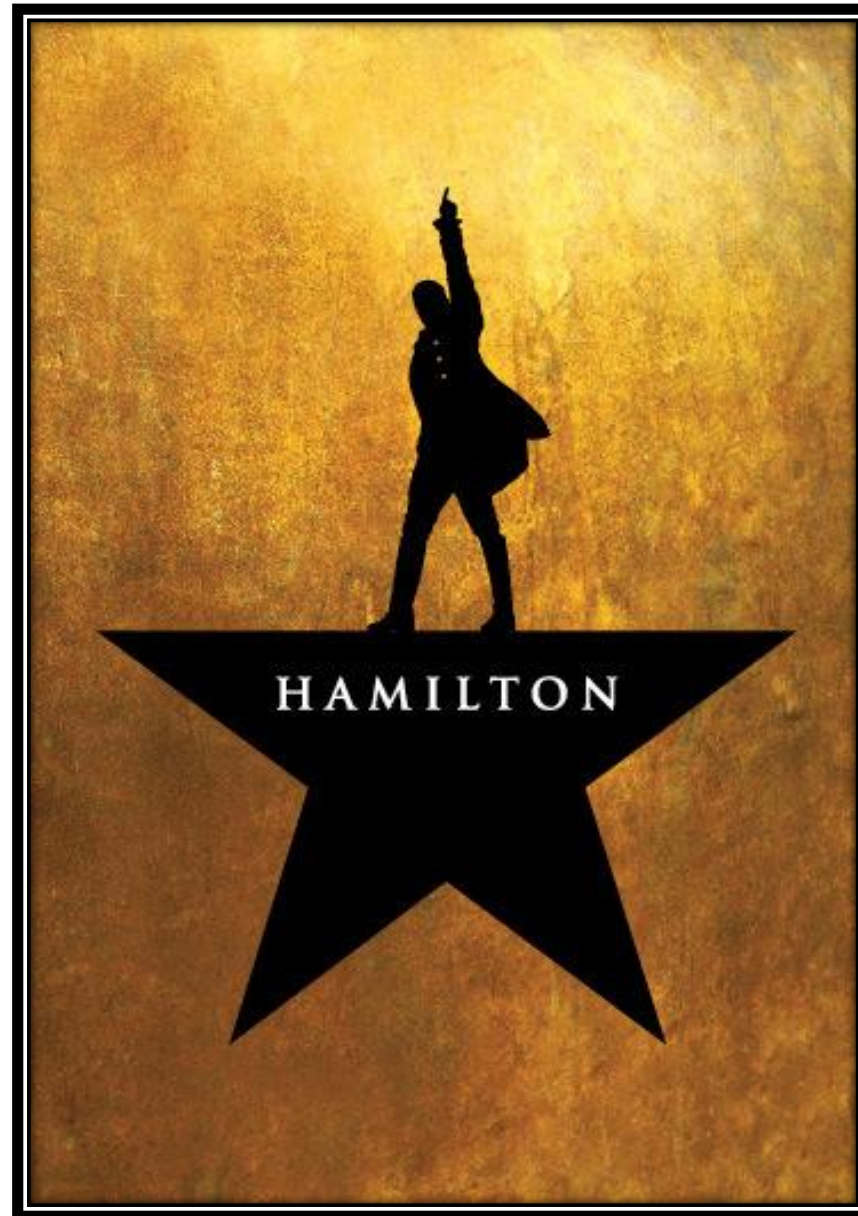
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Relationships with commercial interests:

- Not Applicable

Disclosure of Commercial Support:

- I have nothing to disclose.



Itinerary

- Rheumatoid arthritis
- Hand Impairment and disability in rheumatoid arthritis
- Functional Range of Motion
- Biologics effect on rates of hand surgery
- RA – patient cases
- Boutonniere and Swan neck deformities
- CMC OA
- DIP joint arthritis
- Flexor tenosynovitis



Rheumatoid Arthritis

Rheumatoid Arthritis

- Affects 1% of US population
- 70% of RA pts develop pathologies of the hand, esp MCP joints
- Extensor and flexor tendons of fingers frequently involved
- Wrist involved in 50% of pts within 2 years of Dx and in up to 90% of pts. following Dx diagnosis.

- Up to 70% of RA pts. report hand and wrist dysfunction. Trieb, K, JHS (2008); 33:113-123

Rheumatoid Arthritis: effects on Hands

Effects of RA leading to structural joint deformities:

- Distension of the joint capsule
- Muscle imbalance
- Less motion in joints due to swelling and pain
- Subluxations
- External forces on joints

Impairment can lead to activity limitation and participation restrictions

CDC: Disabilities and Limitations

Disability has no single definition – and people with same diagnosis or cause can be affected in different ways.

Useful to estimate number of people with disability in order to plan for programs and accommodations.

NHIS : “Are you now limited in any way in any of your usual activities because of your arthritis or joint symptoms?”

Prevalence	2013-2015	Projected 2040
Doctor diagnosed Arthritis	22.7%	26%
Arthritis-attributable activity limitation	43.5%	44%

Specific Functional Limitations

9 common daily activities many people with arthritis report as “very difficult” or they “cannot do”

- Grasp small objects
- Reach above one’s head
- Sit for about 2 hours
- Lift or carry as much as 10 pounds
- Climb a flight of stairs without resting
- Push or pull a heavy object
- Walk $\frac{1}{4}$ mile
- Stand for about 2 hours
- Stoop, bend, or kneel

Impairments affecting Function in the hand

- Resulting in activity limitations and restrictions

Impairment	Activity limitations
Joint structural damage	Grasp Most ADLs: eg.brushing teeth, dressing, cooking, etc
Fatigue	8 hour workday Housecleaning
Pain	Difficulty managing coins, therefore avoid shopping

Adaptation Strategies

- Modifying the activity
- Using Assistive devices
- Obtaining assistance from someone else.

Functional Range of Motion in the Wrist

Most commonly affected joint in RA

Ideal wrist ROM for ADL

- 40 degrees each of wrist flexion
- 40 degrees each of wrist extension
- 40 degrees of combined radial-ulnar deviation

Wrist position and Grip strength

Grip strength is stronger with wrist in:

- 25-35 deg extension
- 10-15 deg ulnar deviation

Functional Range of Motion in the Hand

- Functional ROM significantly lower than Active ROM
 - only a small percentage of active range required for functional tasks
- Necessary MCP motion for hand function:

Flexion	>70 deg.
Extension	<30 deg.

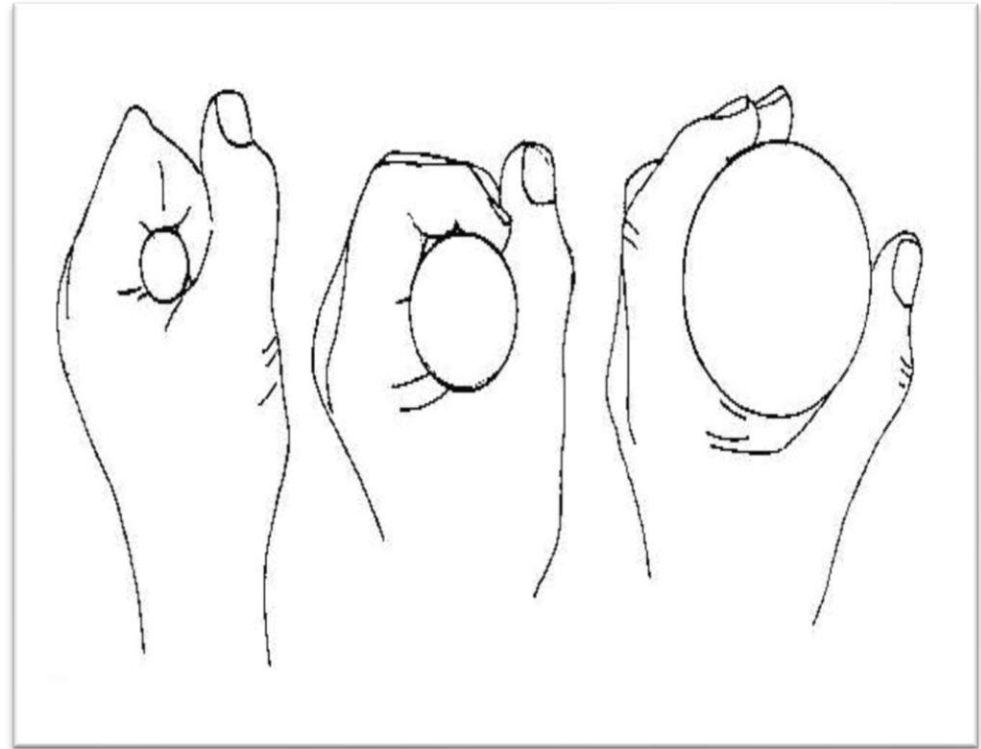
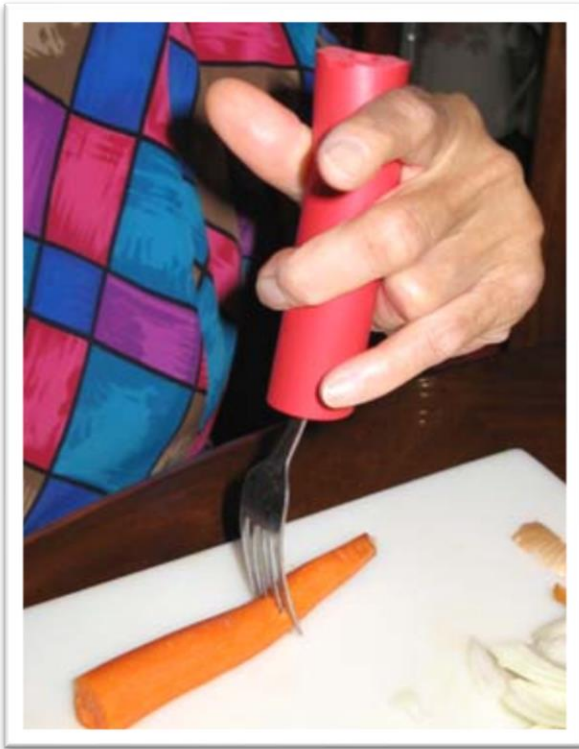
- Significant disability associated with extension lag or lack or ulnar deviation at MCP jts. that prevents pre-grasp - opening hand to grasp an object.
- Limited extension of the PIP (boutonniere) - preserved ability to grasp despite poor appearance

Functional Range of Motion in the Hand

- Pre-grasp: on approach to objects – requires active extension of fingers
- Static grasp – final position

	Pre-grasp	Grasp	
	Extension	Flexion	% AROM
MCP	-05	77	48
PIP	-16	93	59
DIP	-01	72	60

Using enlarged handles decreases the amount of force required to grip.



Assistive devices are not always necessary in spite of how much deformity is present.



Deformities don't always impede function

Typical deformities

Most often due to chronic synovitis disrupting ligamentous support of joints.

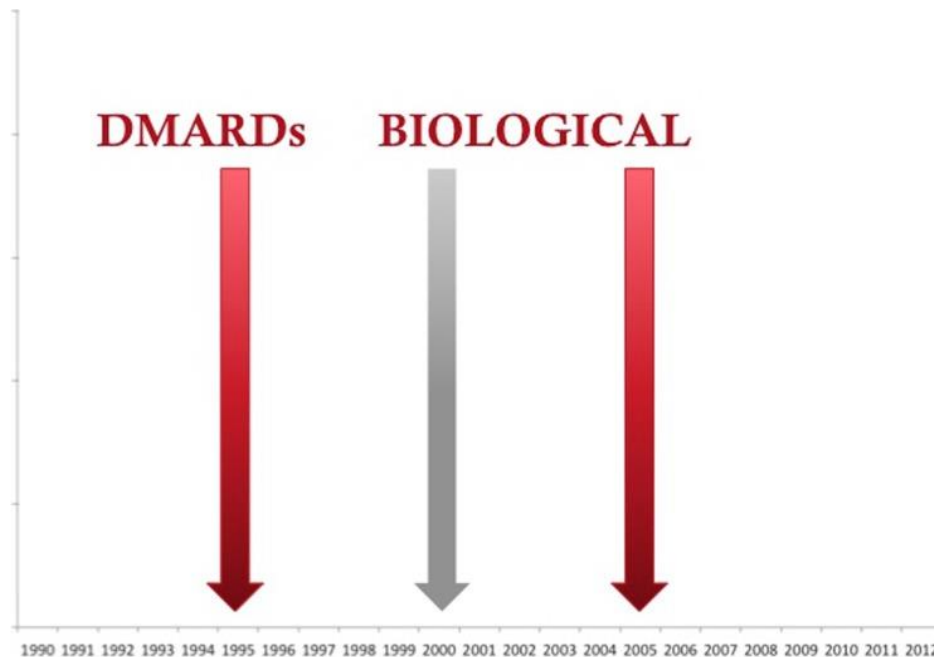
- Wrist: Radial deviation: inflamed extensor tendons deviate radially and dorsally
- MCP joints: Volar subluxation of Proximal phalanges and ulnar drift of fingers
- Thumb: MCP flexion and IP hyperextension – loss of pinch
- Fingers: Swan Neck or Boutonniere

How have Biologics affected rates of Hand Surgery?

Retrospective study at Pulvertaft Hand Centre 1990-2012

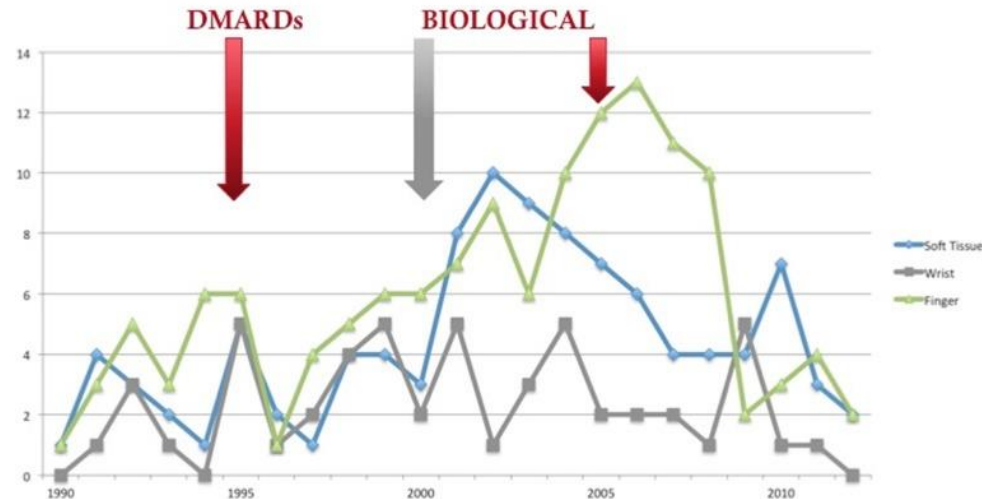
Grey arrow : Introduction of Biologics

Red arrow: True impact likely observed



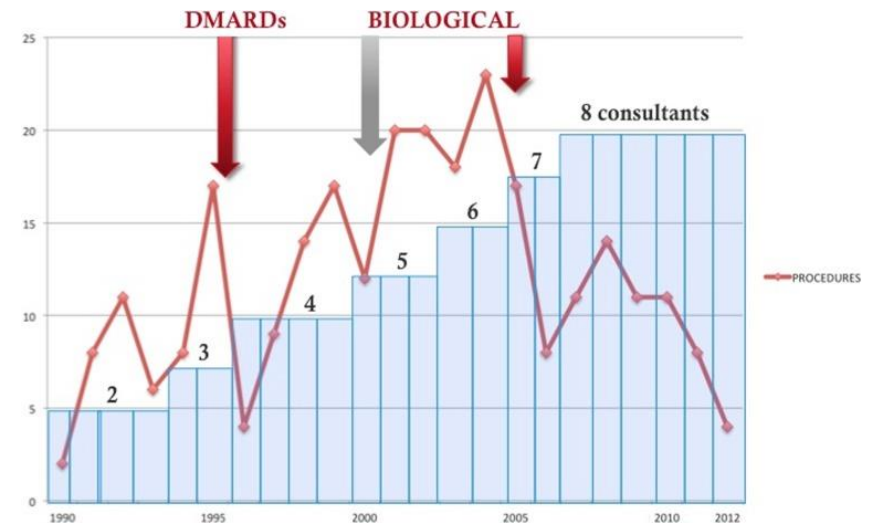
Retrospective study at Pulvertaft Hand Centre 1990-2012

ALL THREE GROUPS



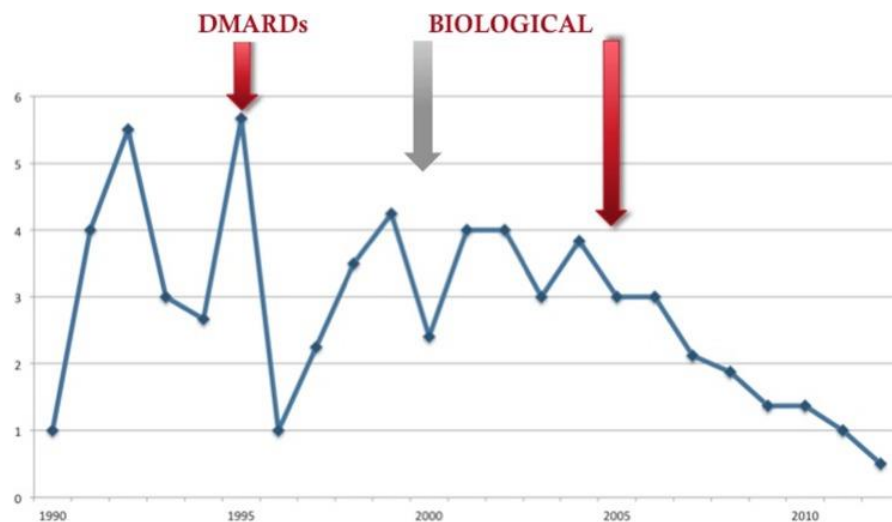
3 index surgical groups over 22 years

Grey arrow : Introduction of Biologics
 Red arrow: True impact likely observed

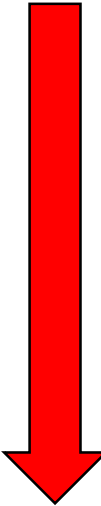


Combined surgical procedures for rheumatoid hand disease plotted against the number of consultant hand surgeons

Retrospective study at Pulvertaft Hand Centre 1990-2012



Number of patients started on biologic therapies by year

2001	3	
2002	13	
2003	34	
2004	55	
2005	48	
2006	81	
2007	81	
2008	78	
2009	104	
2010	108	
2011	90	
2012	120	

Number of rheumatoid hand surgery cases per consultant over time

- Increase in patients starting biologics corresponds to decline in surgical procedures

Decline in hand surgeries in RA patients

- Medical treatment has been successful at preventing disease progression and joint damage
- Aggressive early combination therapies in new and/or active RA.
- Implications:
 - Hand surgeons have a reduced exposure to treating rheumatoid hand deformities

Resting Hand Splints

- Immobilize thumb, digits and wrist
- Resting splint worn at night or when joints are painful
- Appropriate during flare
- Provides pain relief





Rheumatoid Arthritis

2 Patient cases

Rheumatoid Arthritis and Hand deformities

- Mary, 73 yo, 30+ year history of RA, end stage kidney disease
- Wanted to be able to sew on a button
- Ulnar drift of fingers
- Thumb and index did not meet – unable to pinch



Ulnar Drift orthosis



Corrected ulnar drift, but still
unable to pinch thumb and index
together



MCP Stabilizing orthosis

Problem: MCP unstable and rotated with any force in ulnar direction – ie. Lateral pinch

Solution: Orthosis stabilized D2 MCP joint to prevent rotation and ulnar deviation during pinch

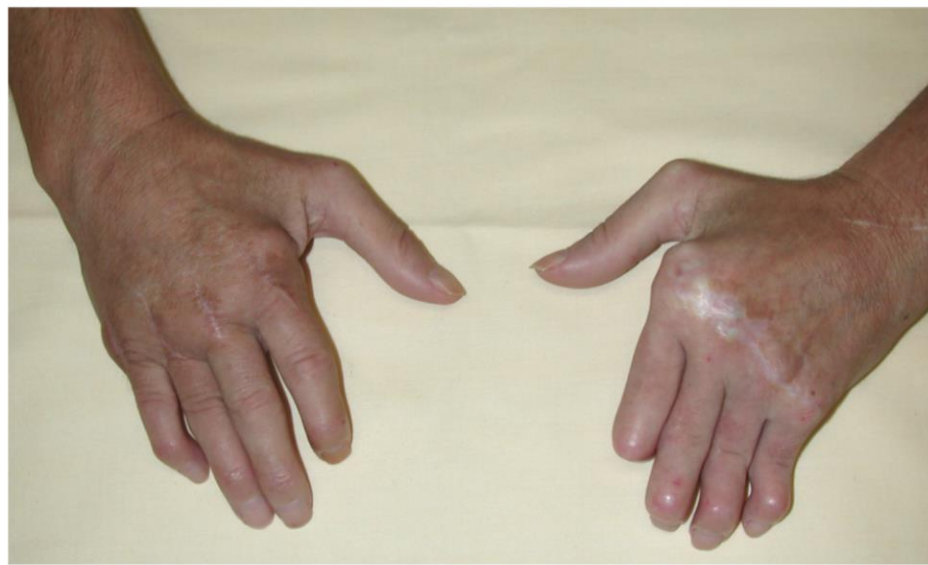


Functional goal met



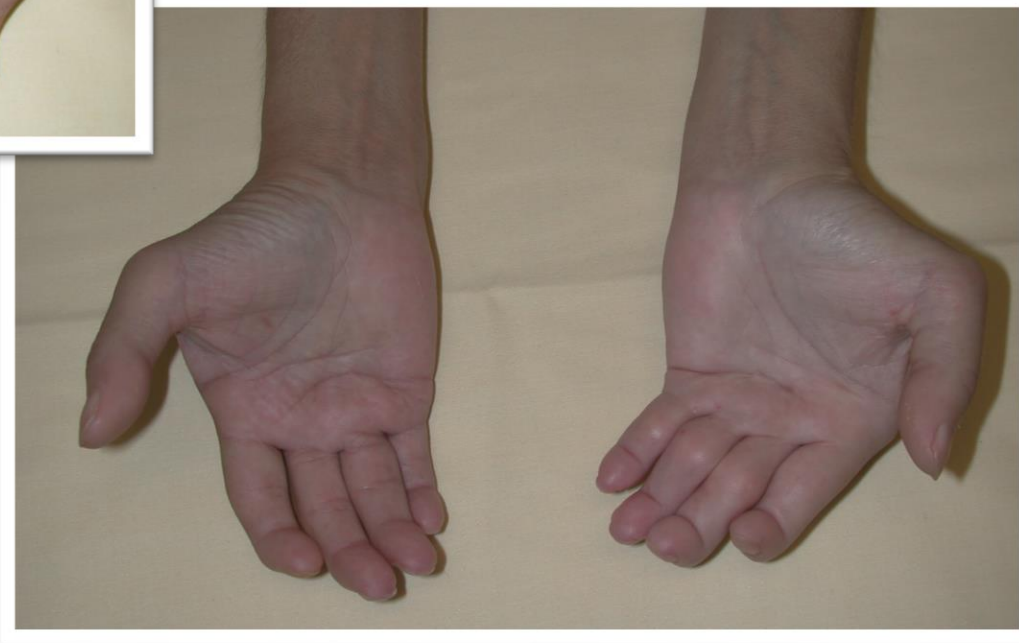
Able to grasp needle
and sew

Post Right MCP Arthroplasty

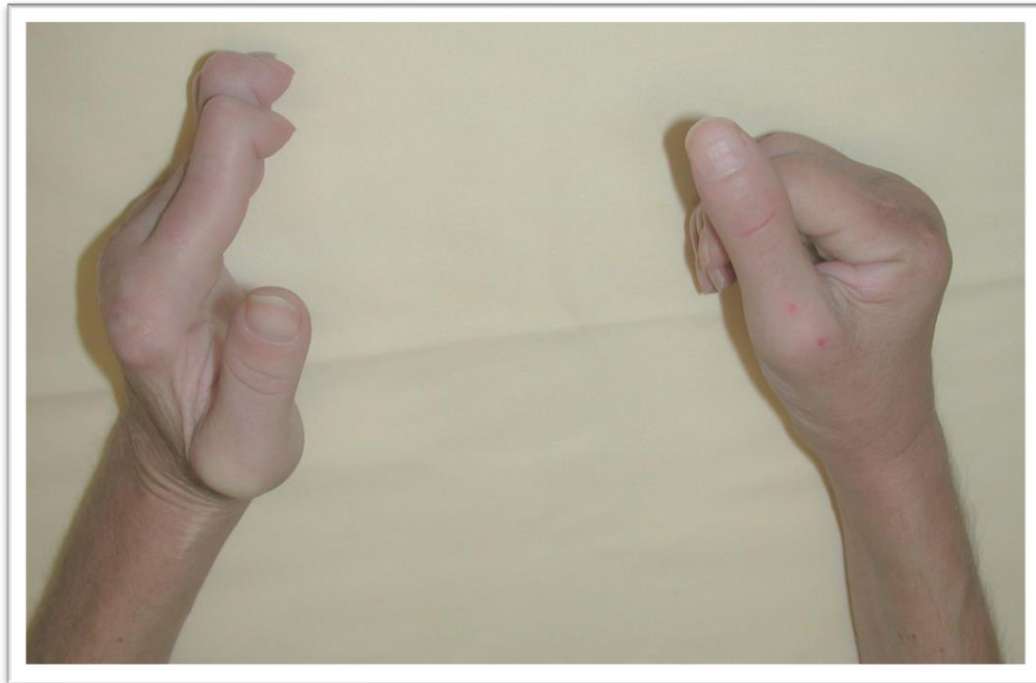


68 yo woman w 25 y Hx of RA. Has had MCP arthroplasty on R – awaiting surgery on Left

Patient was never on biologic therapy



Post Right MCP Arthroplasty

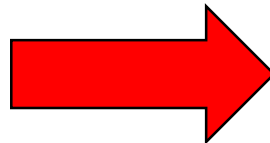


Post Right MCP Arthroplasty



Post-op Resting Hand Orthosis
(no dynamic extension splint)

Finger separator added
to maintain alignment



Post Right MCP Arthroplasty – Ulnar gutter splint



Progressed to small ulnar gutter splint to manage residual drift



Unable to pinch Velcro w Left hand
Adapted strap allowed her to hook thumb

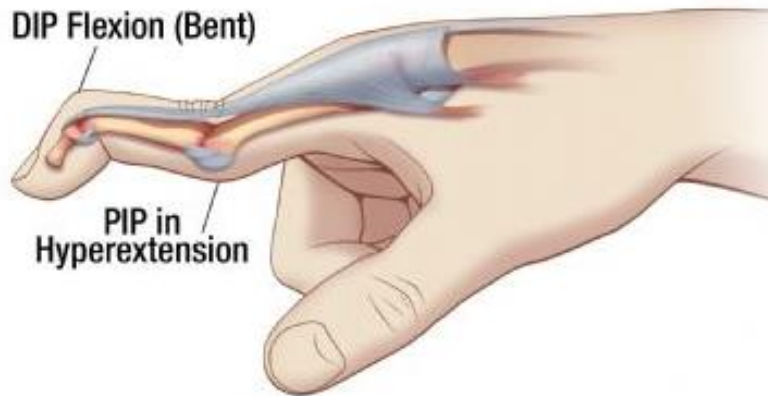


Inflammatory Arthritis

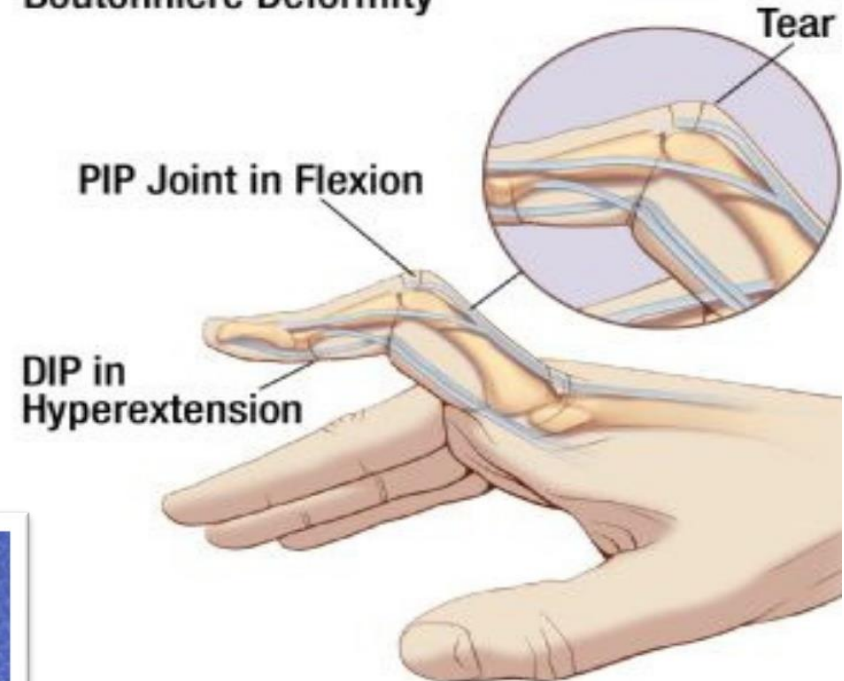
Effects on small joints

Swan Neck vs. Boutonniere Deformities

Swan Neck Deformity



Boutonniere Deformity



Anti-Swan Neck orthoses

- Worn for function + rest, to correct deformity
- Blocks PIP hyper-extension, allows flexion

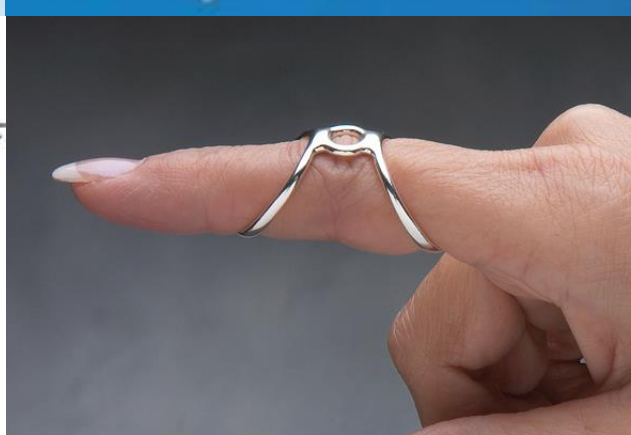
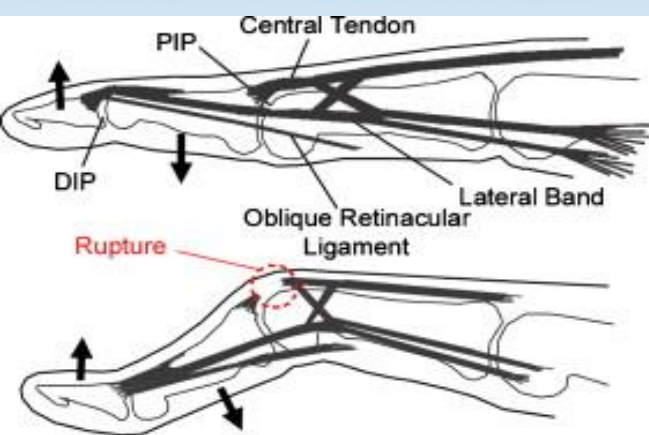


Anti Swan Neck orthoses



Anti-Boutonniere Orthoses

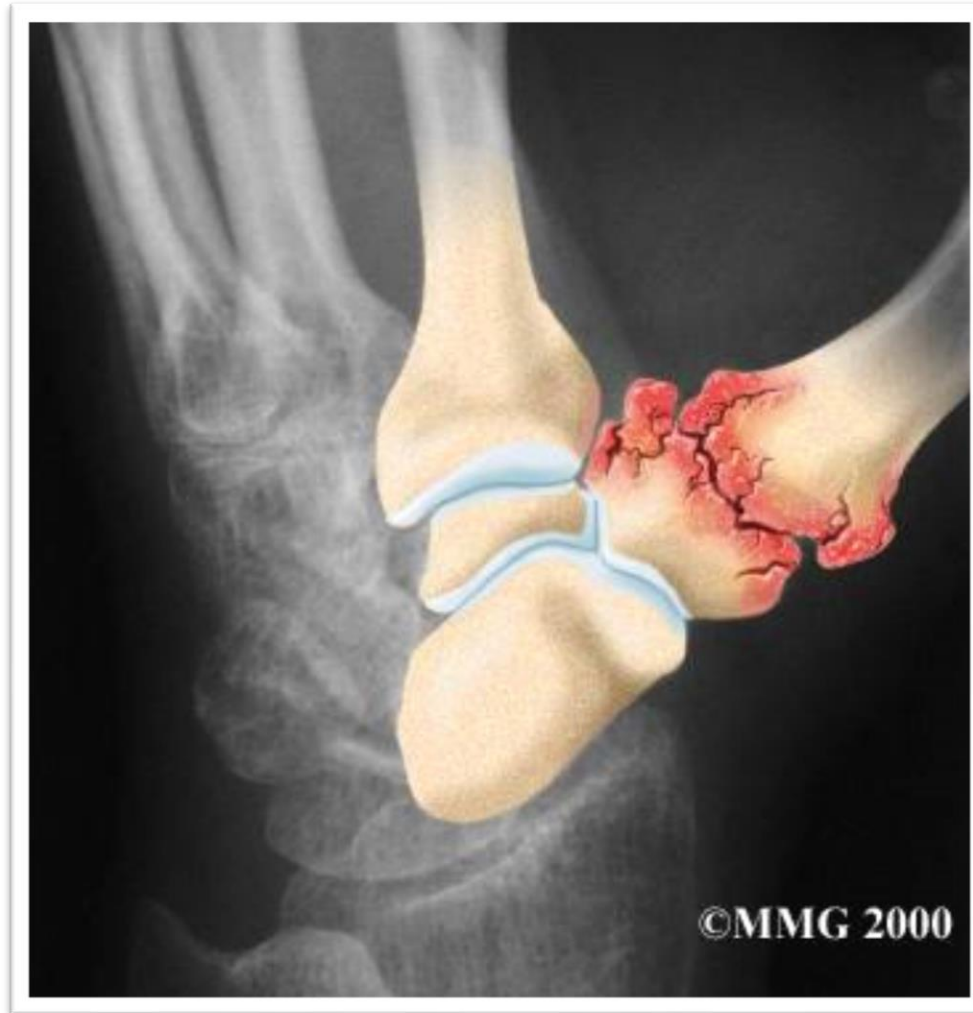
- Worn during day for functional activities to correct deformity
- Applies for to extend PIP, while allowing DIP free to flex





Carpometacarpal/CMC Osteoarthritis

Thumb Carpometacarpal (CMC) Arthritis



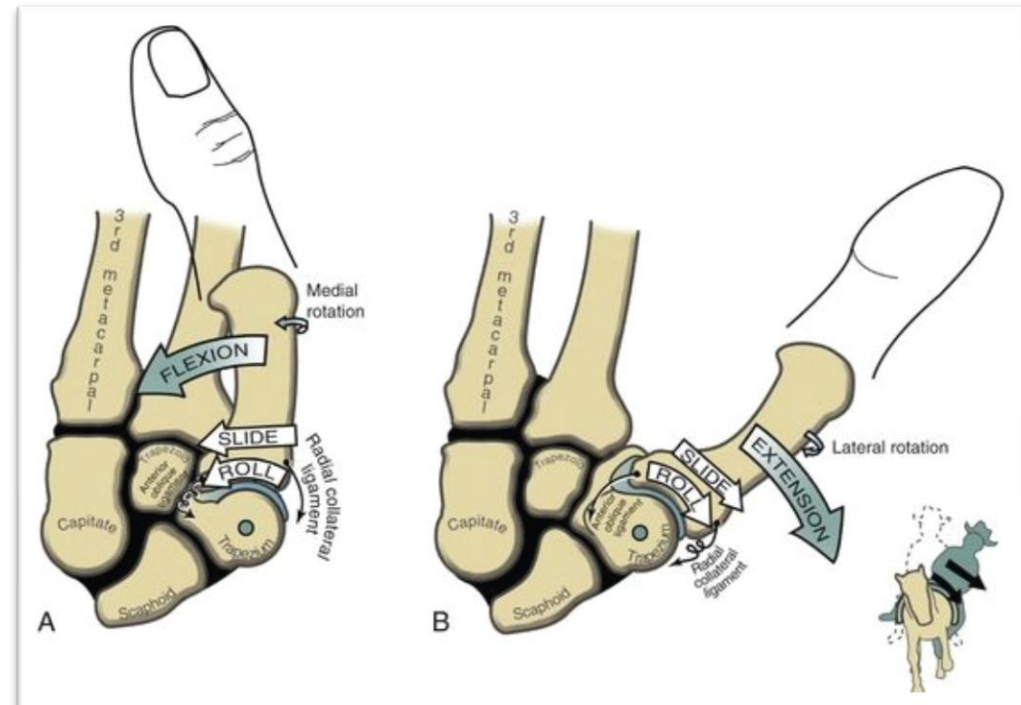
CMC Osteoarthritis

CMC joint enables opposition & allows arcs of movement in 3 planes

1. Flexion-extension
2. Abduction-adduction
3. Opposition

Four Articulations

1. Trapeziometacarpal
2. Trapeziotrapezoid
3. Scaphotrapezial ST
4. Trapezium-Index Metacarpal



Carpometacarpal (CMC) Joint Osteoarthritis

- 50-70 yo female
- Radial sided or thumb pain
- Insidious onset
- Intermittent
- Stiffness (am)
- Exacerbated with ROM
 - Turning doorknobs or jars
 - Handwriting
 - Needlepoint
- Relieved with rest + analgesics



Saddle joint

Minimal osseous stability

Rely on static ligamentous constraints to limit MC base translation

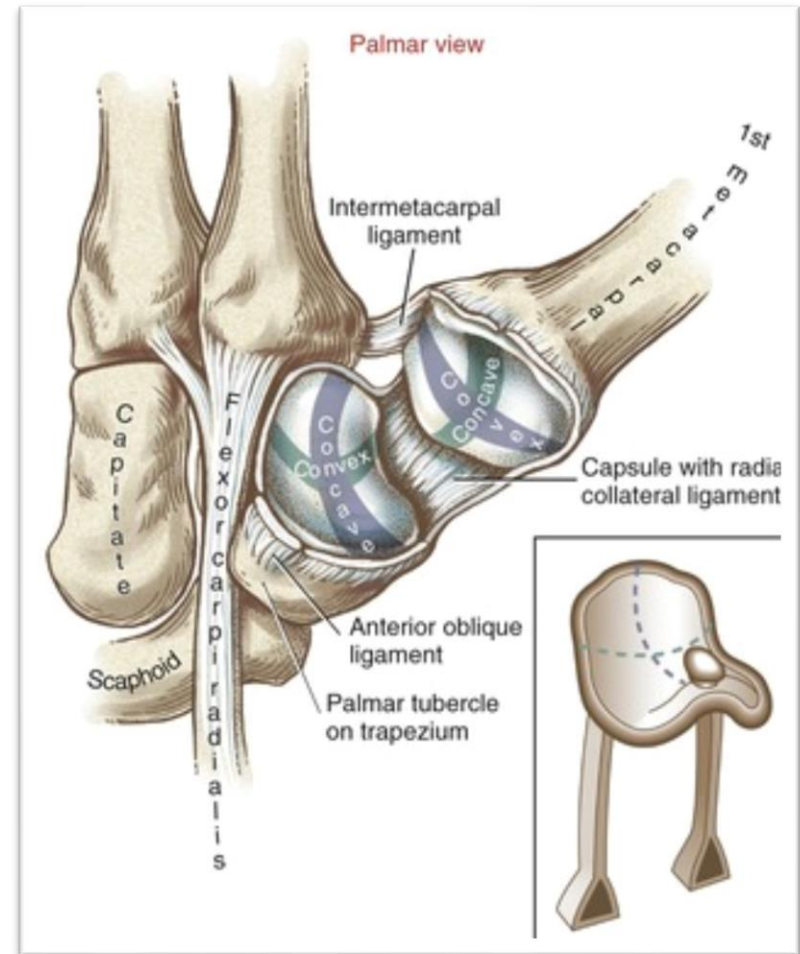
5 stabilizing ligaments

1. Anterior oblique
2. Posterior oblique
3. Anterior intermetacarpal
4. Posterior intermetacarpal
5. Dorsal radiocarpal

Most commonly surgically reconstructed area w OA in arm

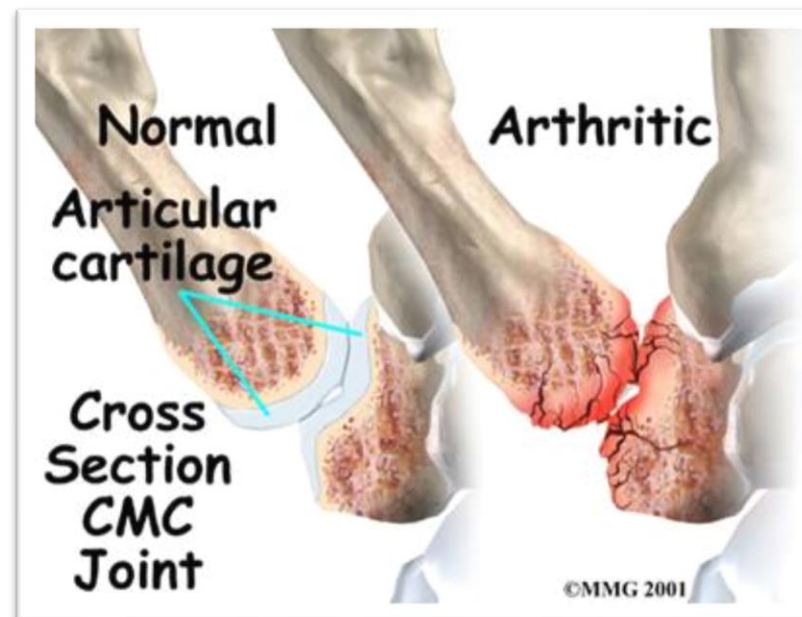
Increased prevalence in women

- Smaller surface area



Etiology

- Secondary to excessive basal joint laxity
- Only the TM & ST joint lie along the longitudinal compression axis of the thumb
 - Radiographic disease most commonly affects these 2 joints
- Cartilage subjected to shear during opposition
 - Axial rotation results in increased contact forces between opposing joint surfaces



Sex differences in thumb CMC OA – Dr. Jennifer Wolf

Epidemiology

- Heavy occupational load – highest odds ratio of OA
- Linear relationship btwn occupational load and OA in men
- Hypermobility
 - supporting ligaments become weak and attenuated w abnormal loads
- Hormones
 - Estrogen replacement is protective against joint degeneration.
 - The more relaxin receptors, the more severe the OA
- History
 - 1949 Trapeziectomy
 - 1966 Fusion
 - 1984 Ligament reconstruction
 - 1996 Arthroscopy
 - 2000 Extension osteotomy
 - 2003 Trapeziectomy and hematoma distraction arthroplasty
 - 2007 Implant, suture suspension arthroplasties
 - 2015 Autologous Fat injection

Physical exam

Inspection

- Swelling, crepitus
- Dorsoradial Prominence of Thumb MC base : shoulder sign
- Adduction contracture (webspace contracture)
- Hyperextension MPJ

Palpation

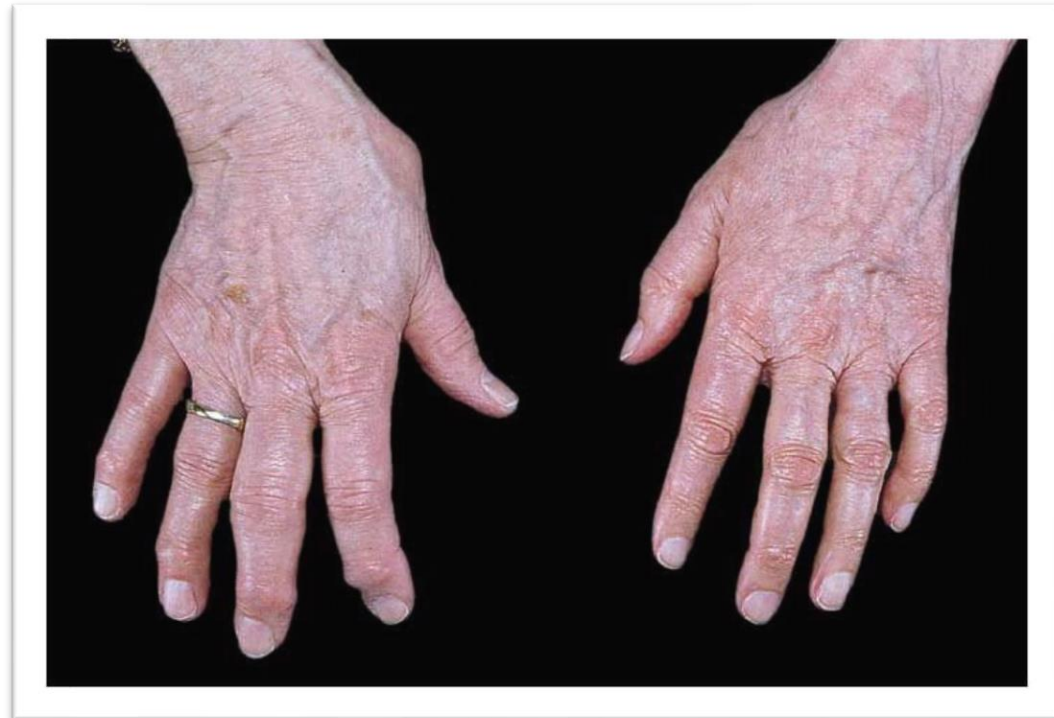
- Focal tenderness TM joint
- ST joint & MP joint

ROM

- Active & Passive
- Laxity at TM joint

Provocative Maneuvers

- Grind Test (axial loading + MC rotation)



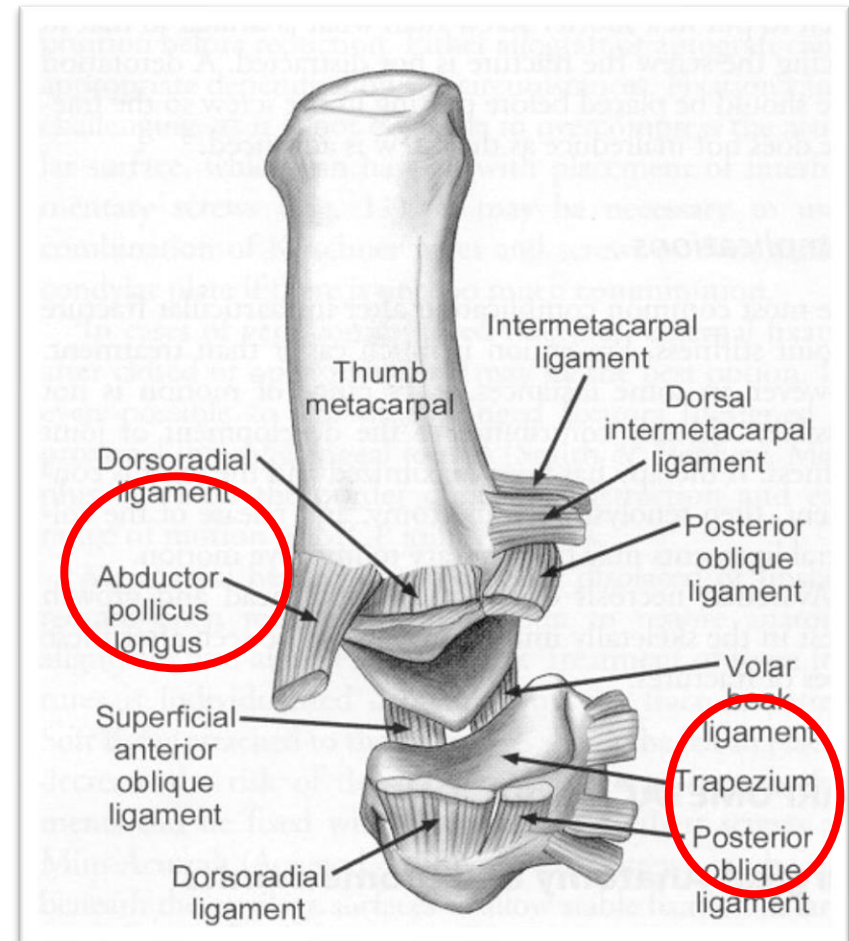
Ligamentous Stability

Anterior Oblique or “Volar beak”

- Primary Stabilizer

Dorsoradial

- Primary restraint to dorsal subluxation



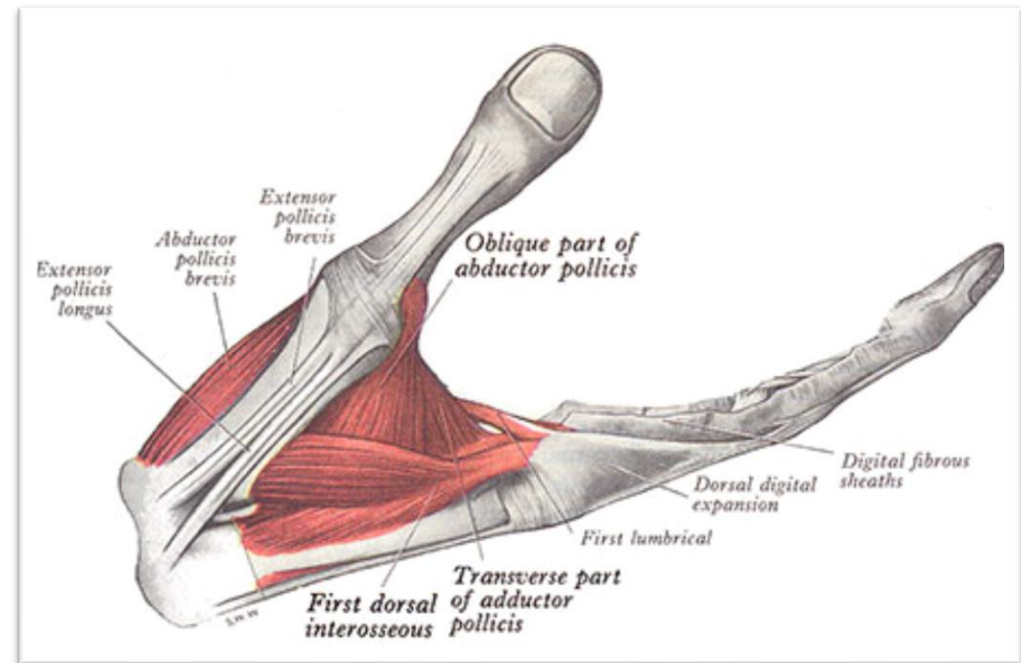
Muscular Stability – 9 muscles

Volar

- APB, FPB, OP
- FPL
- AdP

Dorsal

- APL, EPB
- EPL
- 1st dorsal interossei



Differential Diagnosis

CMC OA

- Pain at base of 1st MC (volar)
- -ve Finkelstein's test
- +ve Grind test
- OA changes on X-ray
- Squaring of CMC joint/subluxation
- Women > men, most common OA of hand
- 50+ yo

DeQuervain's














- Radial wrist pain
- +ve Finkelstein's test
- -ve Grind test
- No changes on X-ray
- Pain on resisted thumb extension
- Pregnancy, repetitive tasks
- Wide age range

Non-Operative Treatment

- Education
- Activity Modification
 - Less forceful pinching
 - Alternate hand use
 - Switching to larger diameter instruments
 - Reading stand to hold books
- Strengthening exercises: intrinsic & extrinsic
- NSAIDS
- Intra-articular Steroid Injections
- Splinting

Dynamic Stability Approach – Thumb CMC

- EMG: Hands w OA had weaker 1st Dorsal Interosseous than no OA
- 1st Dorsal Interosseous: “Lateral thenar muscle” – Brand and Hollister
- Removing tension from 1st DI – radial subluxation of CMC
- Dynamic stability = muscular, osseous and ligamentous contributions
 - Restoration of thumb webspace
 - Re-education of intrinsic and extrinsic muscles
 - 1st dorsal interosseous
 - Thumb opponens
 - Abductors
 - Extensors
 - Joint mobilisation for pain control
 - Muscle strengthening
 - CMC stabilizing orthosis
- Results of retrospective study –Avg visits: 2.37, Avg episode of care: 44.5 days
 - 17.9% reduction in pain
 - 19.3% improvement in Quick DASH

Techniques	Progress	When patient is able to pinch without pain while not wearing orthosis, it's time to begin to wean from orthosis, resuming wear temporarily if pain returns or for heavy activity.
	Pain 0-10 without orthosis During daily activity: At rest: Lbs. pinched:	Record Pain level reported by patient during activity and at rest while not wearing an orthosis. Record #Lbs. pinched. ("Pinching" is not part of this thumb program, so defer further testing during the next two-four sessions, use only <u>Pain-Free pinch testing.</u>)
	Pain 0-10 wearing orthosis Daily activity: At rest: Lbs. pinched:	Record Pain level as above but while wearing orthosis. Describe type of orthosis: Forearm-based, Hand-based, Palm-based, Thenar-based - with or without MP extension block.
	Opposition: Kapandji Scale 0-10/10	Thumb Tip to: Index P1(0) Index P2(1) lateral side of Index P3(2) Index tip(3) long tip(4) ring tip(5) small tip(6) DIP crease(7) PIP crease(8) MP crease(9) Distal Palmar Crease(10)
	Adductor Muscle Release: Pressure, contract-relax, fascial stretching	Record method(s) taught: Pressure to adductor by pinching with opposite thumb or clip, contract-relax with stretch, or manual release. (Picture: Firmly engage web spaces and extend fingers and thumbs to feel stretching of tissues. Hold for 30 seconds. Repeat.)
	Web Space Comparison: After Adductor Release	Report patient's success or failure to widen webspace immediately after performing techniques above.
	Mobilization: Distraction	Instruct patient to grasp involved thumb with opposite hand behind back. Let the weight of the arms distract the joint. Can be done behind back or in front if more comfortable. (Sometimes shoulders are arthritic and painful)
	Mobilization: Reduce dorsal subluxing	Instruct patient to rest involved CMC joint atop skull, insert opposite thumb in webspace, or with gentle self traction on thumb column, hold hand gently and rock it forward and back for 1 to 3 or more minutes. It may feel a bit uncomfortable, but it will be worth it.
	Mobilization: Retro-position	Instruct patient to reach across dorsum of involved hand, wrap fingers around the length of the 1st metacarpal, press hand to chest and gently loosen CMC joint by rolling the involved thumb away from chest. Hold for 1 to 3 or more minutes.
	Strengthening: 1st Dorsal Interosseous	Move the 1st Dorsal Interosseous through full abduction and adduction. Progress: first AROM, then light resistance (rubber band) 10-15x-3x/day, then against maximum resistance: 10-12 times 1x/day.
	"C" Position Strengthening: EPB, ABPB, Opponens	Repeat the same technique while abducting thumb and moving toward opposition. Begin with a light weight rubber band to isolate action, 10-15x-3x/day. Progress to use of opposite hand to provide maximum resistance through full range of motion. 10-12 times/once a day
	Place and Hold	Place thumb in opposition to fingertips. Begin to pinch. If MP starts to collapse, Stop. Repeat place and hold until muscles have retrained to perform a firm tip pinch.
	Proprioceptive/Kinesthetic training: Textile Taping For Day and/or Night	Perform a "trial" of textile taping to test for skin tolerance and response. Inform patient of precautions and correct self application and removal of tape.
	Joint Protection Education & Adaptive Equipment	Based on patient's work and leisure activities, teach joint protection techniques. Keep a supply of Adaptive Equipment for patients to test. Provide suggestions about where to find equipment in stores.
Therapist:		



Splinting

- Decreases pain
- Does not decrease the eventual need for surgery
- Decreases subluxation on pinch for Stage I and II CMCJ
- Long Opponens vs. Short Opponens
 - No clear indications
 - Type of activity performed
- Well-fitted custom splint
- Duration
 - Full time → 3-4 weeks
 - Part time → 3-4 weeks + night use
 - Heavy Activities

Commercially available Orthoses



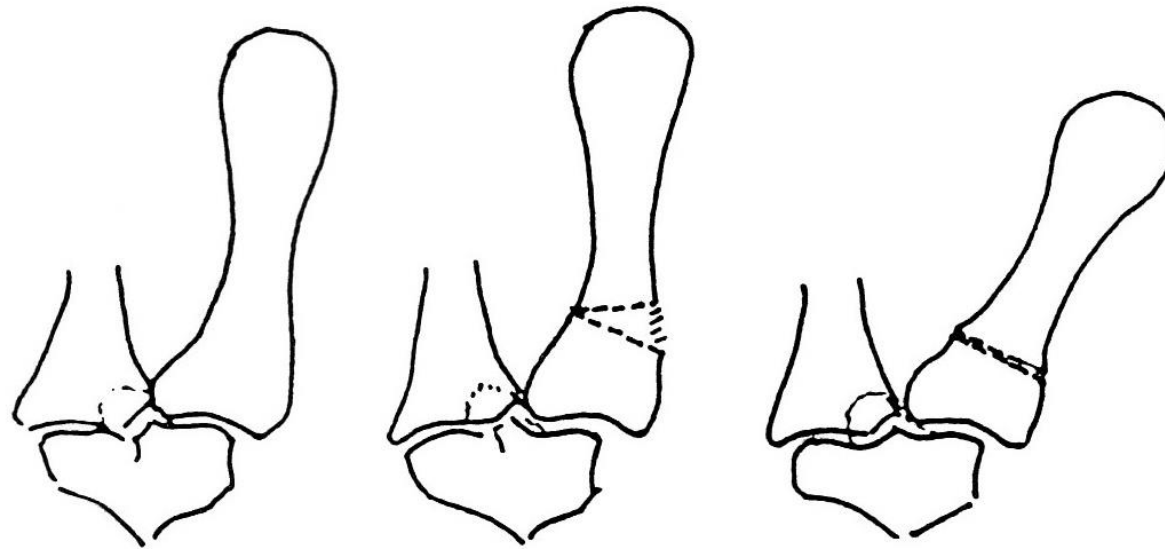
Custom Thermoplastic Orthoses



Surgical Options

- Offered for:
 - Significant loss of function and pain
 - Unsuccessful conservative management
 - Rate of progression
- Surgeon's preference + judgement
- Surgical options:
 - MC Osteotomy
 - Trapeziectomy
 - Ligament Reconstruction Tendon Interposition (LRTI)
 - Suspensionplasty
 - CMC Arthrodesis

MC Osteotomy



- Designed to offset the subluxing forces on the base of the MC
- Usually closing wedge

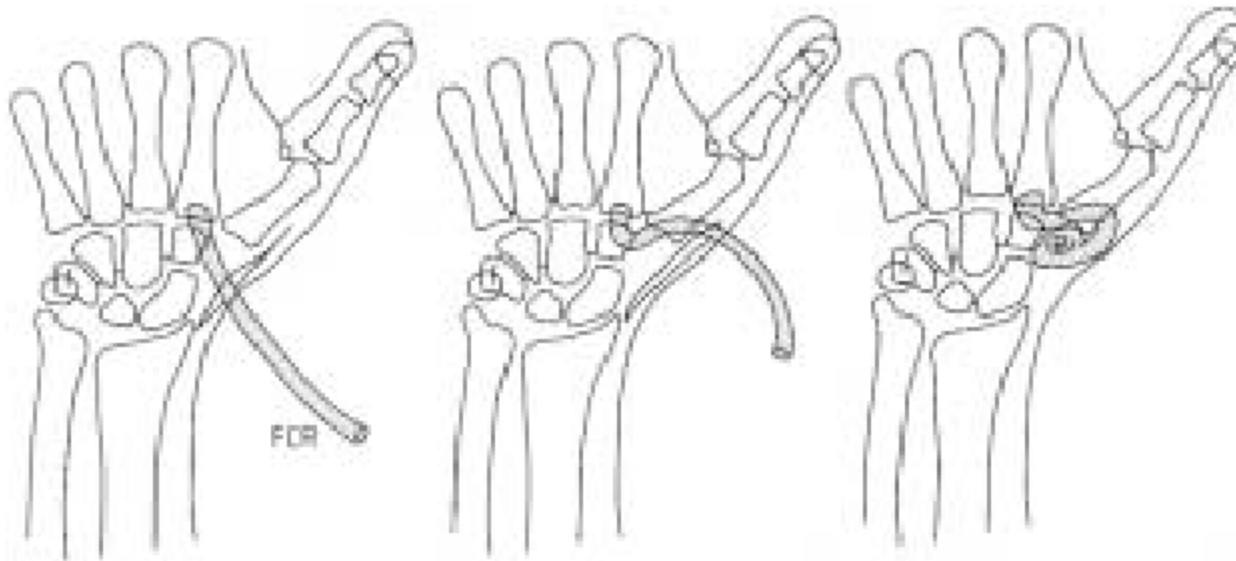
Trapeziectomy w LRTI (Ligament Reconstruction Tendon Interposition)

Stage II / III / IV disease

- Removal of the involved joint
 - partial trapeziectomy Stage II / III
 - Total trapeziectomy Stage IV
- Slip of FCR to stabilize lax volar oblique ligament.
- End of FCR then coiled and inserted into defect to maintain length and provide painless mobility.

Trapeziectomy w LRTI

(Ligament Reconstruction Tendon Interposition)



CMC Arthrodesis

- Indications
 - when major correction of the position of the MC required & a procedure to correct MP Joint hyperextension
 - Young heavy labourers
- Cartilage surfaces debrided, bone graft inserted, then K-Wire pinning, screw (cancellous lag)
- 40⁰ abduction & 45⁰ extension
- Immobilize thumb spica

CMC Arthrodesis



Secondary MCPJ deformity: Hyperextension

Less than 30⁰

1. Transarticular K-Wire with joint in flexion for 4-5 weeks
2. Moving the extensor pollicis brevis from base of proximal phalanx to metacarpal shaft

Greater than 30⁰

1. Arthrodesis (unstable joint)
2. Volar capsulodesis



The Future for CMC OA

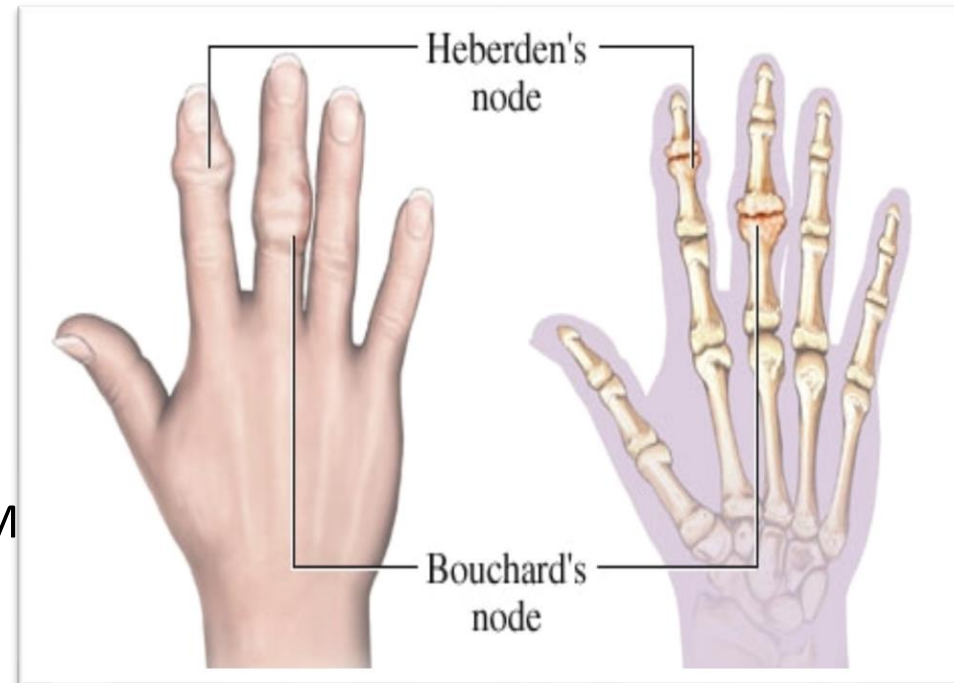
- Autologous Fat transfer injection
- Plasma Rich Protein
- CMC denervation



DIP Joint Arthritis

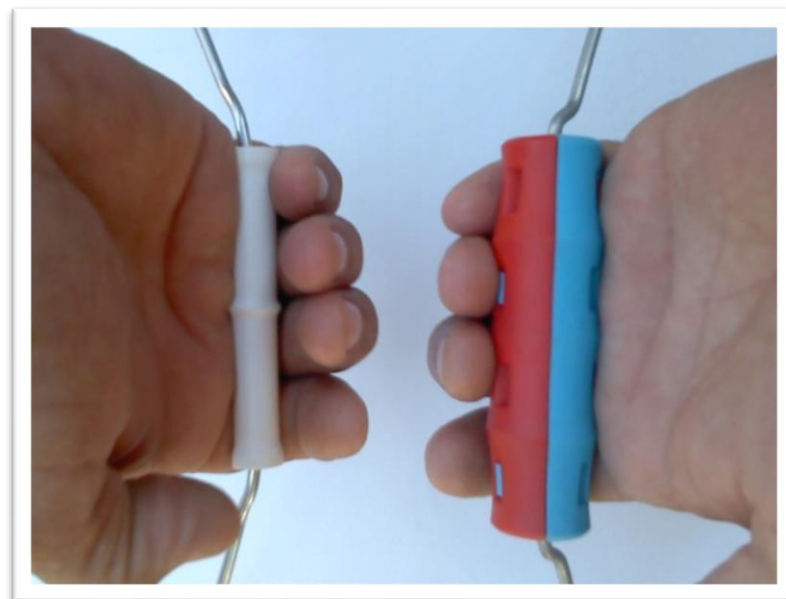
DIP Joint Arthritis

- Most common location in body for OA
 - 58% of individuals 60+ years
- Symptomatology:
 - Joint pain – exacerbated with ROM
 - Change in joint size
 - Radial/ulnar deviations
 - Extension lag
- Osteophyte developed on top or side of joint
 - Heberden's vs. Bouchard's node
- Functionally limiting
 - Opening containers, manipulating small objects/tools



Non-Operative Treatment

- Similar to CMC joint OA treatment...
- Education re: joint protection
- Activity Modification
 - Less forceful gripping
 - Alternate hand use
 - Switching to larger diameter instruments
- Gentle active ROM
- NSAIDS
- Intra-articular steroid injections
- Splinting



Splinting

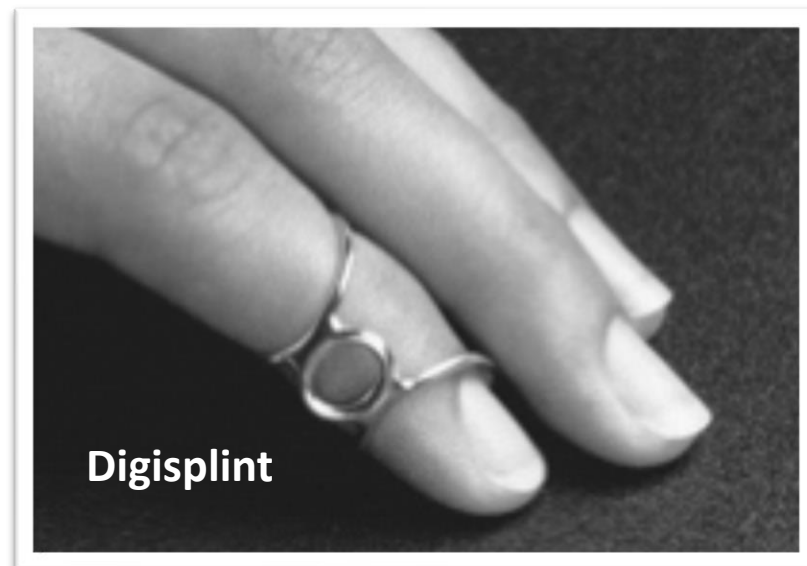
- Decreases pain
 - 66% improvement in pain symptoms with splinting during activity for DIPJ OA (Ikeda, et al., 2010)
 - Use of a splint during sleep decreased pain and improved DIP OA deformity in 3 months (Watt, et al., 2014)
- Potential prevention of deformity progression
- Position to promote finger functioning



Ikeda M, Ishii T, Kobayashi Y, Mochida J, Saito I, Oka Y. (2010) Custom-made splint treatment for osteoarthritis of the distal interphalangeal joints. *J Hand Surg Am* 35:589–93.

Watt, F.E., Kennedy, D.L., Carlisle, K.E., Freidin, A.J., Szydlo, R.M., Honeyfield, L., Satchithananda, K., & Vincent, T.L. (2014). Night-time immobilization of distal interphalangeal joint reduces pain and extension deformity in hand osteoarthritis. *Rheumatology (Oxford)*, 53(6): 1142-1149

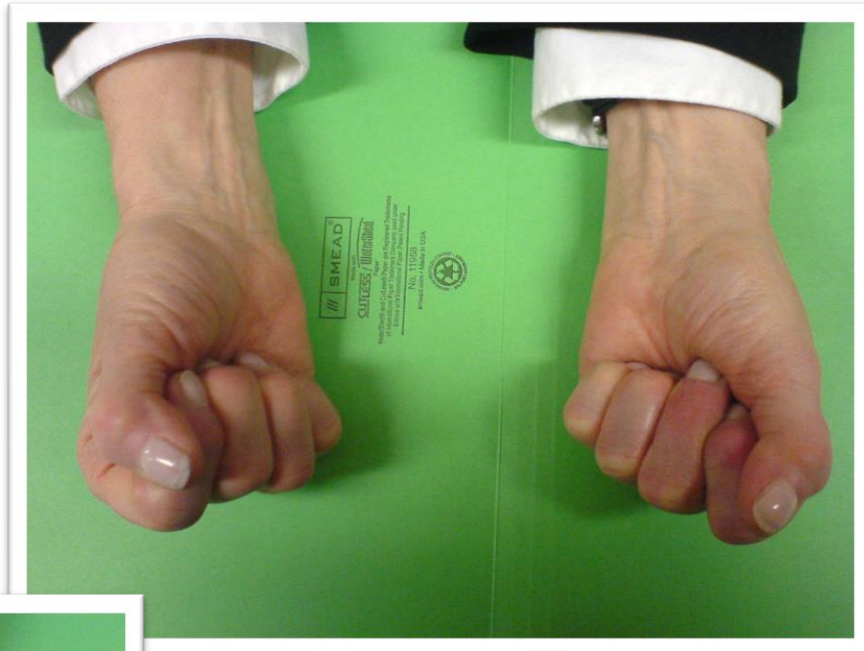
Splinting



DIP joint splinting



Index and
small finger
DIP
deviations



Maintains good,
functional fist

Custom DIP joint splinting



Splinting Alternatives

- Tape, coban
- Advantages:
 - Compression
 - Neutral warmth
 - Easy access and affordability
 - Pain reduction
- Disadvantages:
 - Hygiene
 - Obstructs sensory input



Operative Treatment

- Offered for:
 - Significant pain
 - Rate of Progression

- Surgical option:
 - Arthrodesis



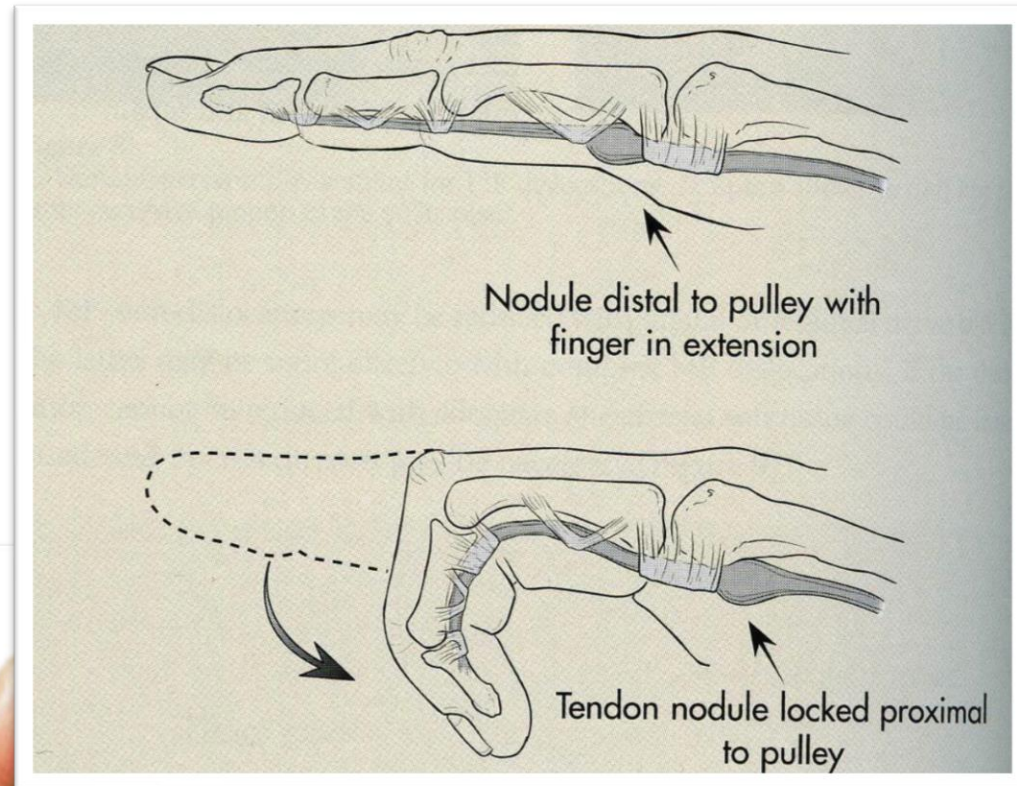
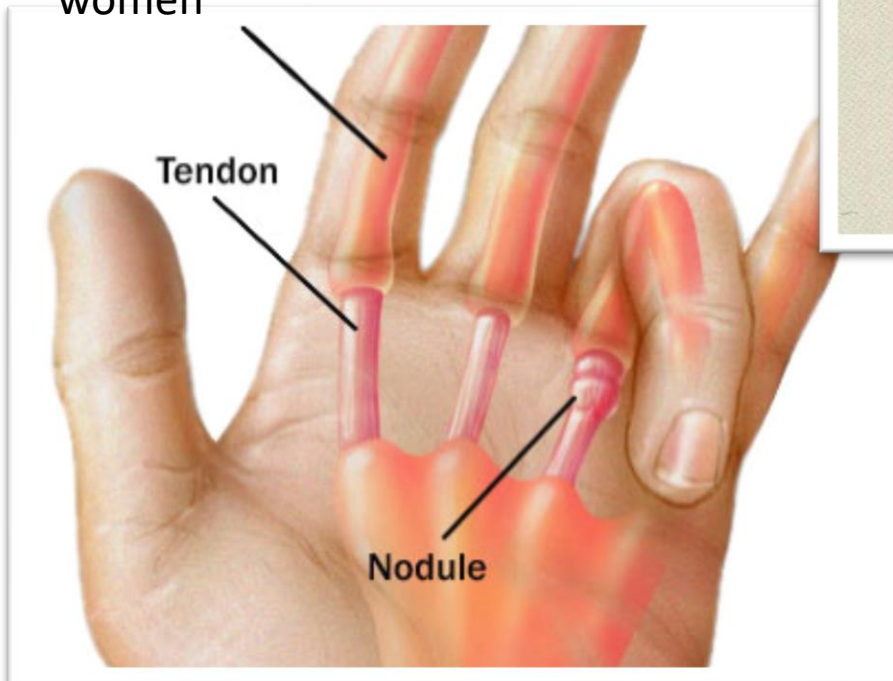
Stenosing Flexor Tenosynovitis



Trigger Finger

Trigger Finger

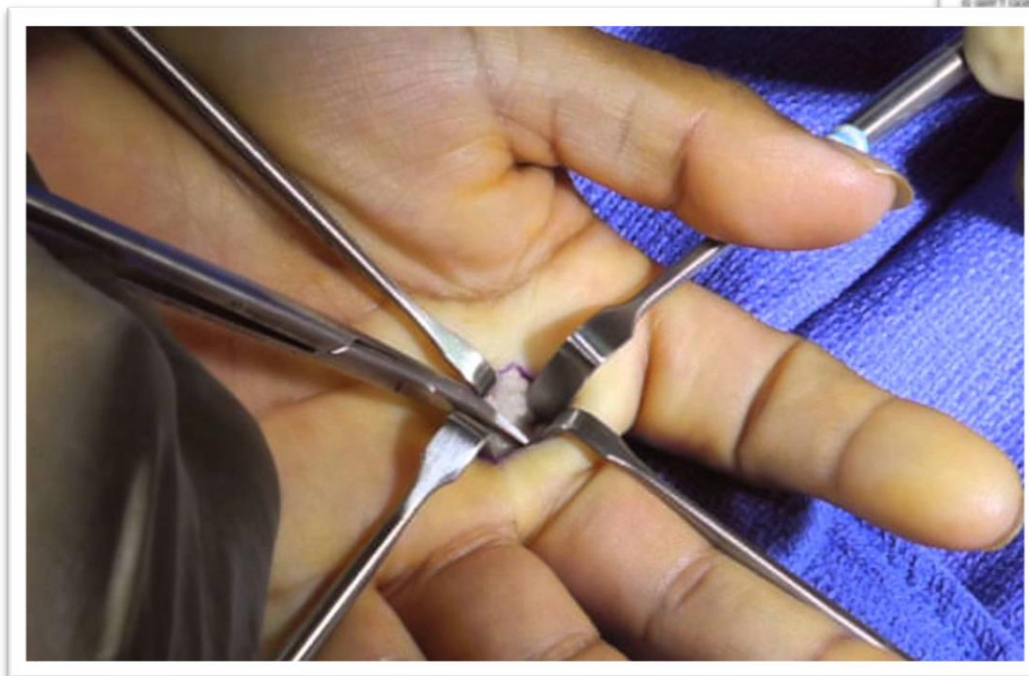
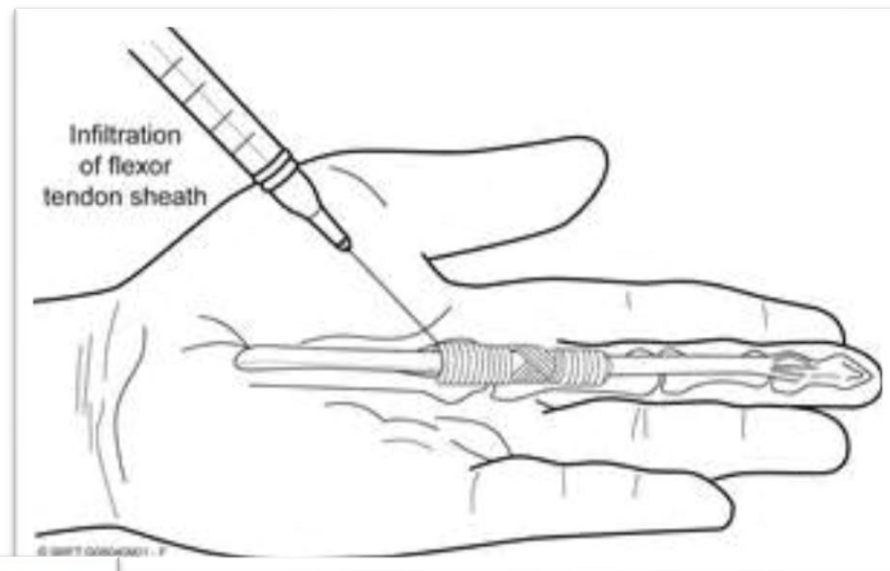
- A1 pulley nodule
- Locking or flexed posture **CAN** be overcome
- Clicking/popping sensation (“stiffness”)
- Inflammation in the tendon sheath that impairs smooth gliding
- DM, RA, Repetitive Hand motion, women



<http://www.eatonhand.com/hw/hw022.htm>

Refer for Steroid Injection or A1 Pulley Release:

- Catching at least once a day
- Conservative Rx not working
- Hand ROM is affected
- 2 Steroid Injections (Surgery)



Steroids vs. Surgery

Steroids

Complications:

- Tendon Rupture
- Skin Pigmentation changes
- Nerve Injury

Healing Time:

- ROM immediately
- Massage



Surgery

Complications:

Tendon

Rupture/Laceration-

rare case studies only

Nerve Injury-rare case

studies only

Painful Scar –

uncommon

Healing Time:

2 weeks for skin

ROM immediately

Non- surgical treatment



Start with the DIP



Low cost option:

Tape DIP joint to prevent migration of nodule thru pulley



Move proximally and block MCPJ

Remind patients:

This is not a party trick!



Multiple fingers

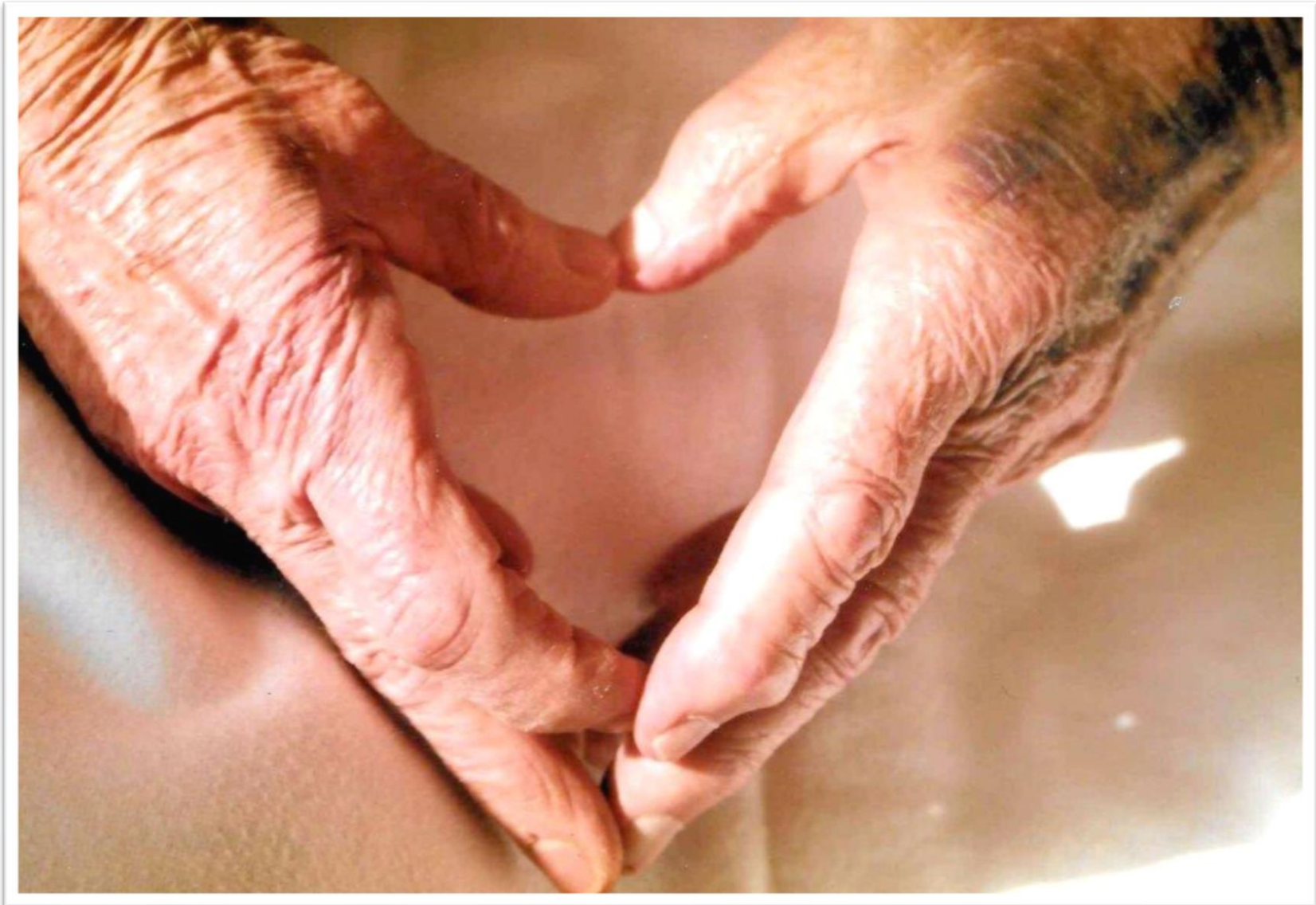


Trigger thumb – block IP joint

Take Home Message

Hand Arthritis: Conservative Treatment

- Education:
 - Joint protection
 - Energy conservation
- Assistive devices/ADL adaptations
- Splinting
 - Rest
 - Correct deformity
 - Functional



Take Home Message

- REST – Teach patients the value of rest
- STOP Offending Activity
- PRESERVE mobility



“PNUT -
Finger tutting”

<https://youtu.be/gQVxE0NF8xc?t=27s>

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<https://macdailynews.com/2020/02/19/larry-tesler-apple-employee-who-created-cut-and-paste-dead-at-74/>



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Computer scientist behind 'cut-copy-paste' has died at age 74.

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