INTRINSIC ANATOMY AND DYSFUNCTION

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“IF I HAVE SEEN FURTHER.... IT IS BY STANDING UPON THE SHOULDER OF GIANTS.”

SIR ISAAC NEWTON, 1675
MENTORING

Most successful people in different areas can point to an individual(s) or mentor who was crucial to their career growth and success.
MENTORING

- TEACHER SUPPLIES INFORMATION IN A NEUTRAL FASHION
- MENTORING IMPLIES A BONDING BETWEEN THE MENTOR AND THE MENTEE
- RELATIONSHIP IS PERSONAL AND ALMOST FAMILIAL IN NATURE
- MAY BE SINGULAR OR MULTIPLE
WILLIAM F ENNEKING

MENTOR
- RESPECTED
- TRUSTED
- ACCOMPLISHED
- CONFIDENT
- ACCESSIBLE
RICHARD J SMITH

- CHIEF OF HAND SURGERY MASS GENERAL HOSP 1972 – 1987
- FORMER PRESIDENT OF THE ASSH 1931 – 1987
- THE GREAT COMMUNICATOR
RICHARD J SMITH

- OVER 100 ORIGINAL CONTRIBUTIONS TO HAND LITERATURE
- BOSTON 1975 – 76
- KAPLAN, PULVERTAFT, FLATT
WILLIAM BURKHALTER

MENTOR: IMPARTS KNOWLEDGE, EXPERIENCE, SUPPORT

ENABLES MENTEE TO DEVELOP SKILLS MUCH MORE RAPIDLY THAN WHEN RELATIONSHIP IS LACKING
WILLIAM BURKHALTER

- CHIEF OF ORTHO
  85th EVAC HOSP
  VIETNAM 1965-66
- CHIEF OF HAND
  SURGERY UNIV OF MIAMI 1974 – 1991
- 1928 - 1992
INTRINSIC MECHANISM
EXTRINSIC EXTENSOR

DORSAL COMPARTMENTS

- 1ST  EPB, APL
- 2ND  ECRL, ECRB
- 3RD  EPL
- 4TH  EIP, EDC
- 5TH  EDQ
- 6TH  ECU
JUNCTURAE
STABILIZE THE DORSAL HOOD WHEN THE MCP JOINTS ARE FLEXED
INTEROSSEOUS MUSCLES

- 4 DORSAL
  - 1ST, 2ND, 4TH HAVE TWO MUSCLE BELLIES
  - 3RD HAS ONLY ONE
- 3 VOLAR ONE MUSCULAR ORIGIN
INTEROSSEOUS MUSCLES

4 DORSAL INTEROSSEI

- 1\textsuperscript{st}, 2\textsuperscript{nd}, 4\textsuperscript{th}

DEEP BELLY

- ORIGIN METACARPAL DIAPHYSIS
- SPIRALS AROUND THE MORE SUPERFICIAL BELLY
- PASSES SUPERFICIAL TO SAGITTAL BANDS
- INSERTS ON THE DORSAL HOOD
- FLEX MCPJ, EXTEND PIPJ
INTEROSSEOUS MUSCLES

4 DORSAL INTEROSSEI

- 1st, 2nd, 4th

SUPERFICIAL BELLY

- ORIGIN: ADJACENT SIDES CONTIGUOUS METACARPALS
- RUNS DEEP TO THE SAGITTAL BANDS
- INSERTS ON TUBERCLE P1
- ACTS ONLY AS ABDUCTOR
INTEROSSEOUS MUSCLES

4 DORSAL INTEROSSEI

- 3<sup>rd</sup> DORSAL

- ORIGIN: 3<sup>rd</sup> / 4<sup>th</sup> METACARPALS
- SINGLE MUSCLE BELLY
- INSERTS ON DORSAL HOOD -- NO INSERTION ON BONE
- LITTLE MOTION OF MIDDLE TOWARD RING
INTEROSSEOUS MUSCLES
3 VOLAR INTEROSSEI

- ORIGIN: CONTIGUOUS METACARPAL SHAFTS
- SUPERFICIAL TO SAGITTAL BANDS
- INSERT INTO DORSAL HOOD ON ULNAR SIDE OF INDEX AND RADIAL SIDE OF RING AND SMALL
INTEROSSEOUS MUSCLES
INTEROSSEOUS MUSCLES

SUMMARY

1ST 2ND 4TH DORSAL INTEROSSEI
- 2 MUSCLE BELLIES
- INSERTION
  - BASE OF P1
  - DORSAL HOOD

3RD DORSAL INTEROSSEOUS AND ALL 3 VOLAR INTEROSSEI
- SINGLE BELLY
- SINGLE INSERTION DORSAL HOOD
LUMBRICAL

RADIAL SIDE
LUMBRICAL

- Extends IPJ irrespective of MCPJ position
- Facilitates IPJ extension by pulling profundus distally
- Initiates MCPJ flexion
- Radial deviation of digit
EXTRINSIC EXTENSOR

- SAGITTAL BANDS
  - ARISE FROM THE EDC TENDON
  - INSERT ON THE VOLAR PLATE
  - EXTEND THE MCP JOINT
  - STABILIZE THE EDC TENDON OVER THE JOINT
SAGITTAL BANDS
TRANSVERSE FIBERS
TRANSVERSE FIBERS
DORSAL HOOD

Diagram showing the movements of flexion and extension in the context of a dorsal hood.
OBLIQUE FIBERS

LATERAL BAND
CENTRAL SLIP

CONTAINS BOTH INTRINSIC AND EXTRINSIC COMPONENTS
CONJOINED LATERAL BAND

- BOTH INTRINSIC AND EXTRINSIC COMPONENTS
- AT THE LEVEL OF THE PIP JOINT
TRIANGULAR LIGAMENT

- TRANSVERSE THIN FASCIA CONNECTING CONJOINED LATERAL BANDS JUST DISTAL TO CENTRAL SLIP INSERTION
- PREVENTS VOLAR SUBLUXATION OF THE LATERAL BANDS
TERMINAL TENDON

- CONVERGENCE OF TWO CONJOINED LATERAL BANDS
- INSERTION INTO DORSAL BASE OF DISTAL PHALANX
TRANSVERSE RETINACULAR LIGAMENT

- ORIGIN: EDGE OF FLEXOR TENDON SHEATH AT PIPJ
- INSERTION: LATERAL EDGE OF CONJOINED LATERAL BANDS
- PREVENTS EXCESSIVE DORSAL SHIFT OF LATERAL BANDS
OBLIQUE RETINACULAR LIGAMENT

- **ORIGIN:** VOLAR LATERAL CREST OF PROXIMAL PHALANX
- **INSERTION:** LATERAL TERMINAL TENDON
- **VOLAR TO AXIS OF PIPJ**
- **DORSAL TO AXIS OF DIPJ**
- **ACTIVE TENODESIS TO INITIATE DIPJ EXTENSION**
OBLIQUE RETINACULAR LIGAMENT
OBLIQUE RETINACULAR LIGAMENT

PIPJ EXTENSION

PIPJ FLEXION
INTRINSIC TIGHTNESS
INTRINSIC TIGHTNESS

CAUSES

– FIBROSIS
– ISCHEMIA
– SPASM
– NEUROMUSCULAR (CVA)
– PARADOXICAL EXTENSION
INTRINSIC TIGHTNESS
INTRINSIC POSITIVE

[Image of a hand with markings on the fingers, labeled TRL]
SWAN NECK

CAUSES

- Mallet
- PIPJ Synovitis
- Interosseous Muscle Contracture
- Volar Subluxation Prox Phalanx
- EDC Subluxation
- FDS Dysfunction
BOUTONNIERE
INTRINSIC MINUS ULNAR NERVE DYSFUNCTION

- CLAW DEFORMITY
- LOSS OF GRIP STRENGTH
- ASYNCHRONOUS MOTION
  - MCP / IPJ FLEXION
  - MCPJ FLEXION / IPJ EXTENSION
- LOSS OF ABDUCTION – ADDUCTION
- LOSS OF PINCH STRENGTH / ADDUCTION
ULNAR NERVE PALSY

- CLAW DEFORMITY
  - MCPJ HYPEREXTENSION
  - IPJ FLEXION
- INTRINSIC WASTING
- WARTENBERG
- FLATTENED PALMAR ARCH
CLAW DEFORMITY
Figure 8. The force of the interosseous tendons applied to the angles of the diamond tends to widen and shorten the diamond. This results in a partial relaxation of the medial extensor tendon. (After G. Stack.) The force of the extensor communis is then transmitted to the distal phalanges.

P₁ and P₂ = distal and middle phalanges.
I.O. = interosseus muscle.
E.C. = extensor communis.
CLAW DEFORMITY

- WITH INTRINSIC PARALYSIS, FULL PIP JOINT EXTENSION CAN BE ACHIEVED IF MCP JOINT HYPEREXTENSION IS PREVENTED
- LONGSTANDING PIPJ FLEXION MAY LEAD TO ATTENUATION OF THE CENTRAL SLIP
- BOUVIER
BOUVIER MANEUVER
WARTENBERG

ECCENTRIC INSERTION EDQ
ULNAR NERVE PALSY

WASTING

LOSS OF ARCH
THOMAS SIGN

- SUBCONSCIOUS ATTEMPT TO GAIN GREATER POWER AND EXCURSION OF EDC’S
- EXAGGERATES MCPJ HYPEREXTENSION
FROMENT’S SIGN
FROMENT’S SIGN

JULES FROMENT (1878-1946)
- NEUROLOGIST, LYON
- WW I – LARGE NUMBER NERVE INJURIES
- THE SIGN OF THE THUMB

MANNERFELT
- HYPERFLEXION OF THE THUMB IPJ DUE TO SUBSTITUTION OF THE SECONDARY ADDUCTOR OF THE THUMB -- THE EPL
IDEAL TREATMENT

- PREVENT MCPJ HYPEREXTENSION
- PROVIDE IPJ EXTENSION
- PROVIDE ACTIVE MCPJ FLEXION
- RESTORE ABDUCTION OF INDEX
TREATMENT

- FULL PASSIVE ROM JOINTS
  - SPLINTS
  - SERIAL CASTS
  - CAPSULECTOMY
TREATMENT

PREVENT MCPJ HYPEREXTENSION

- LUMBRICAL BAR
- DERMODESIS
- VOLAR CAPSULORRHAPHY (ZANCOLLI)
- TENODEESIS
  - PARKES
  - RIORDAN
TREATMENT

PROCEDURES FOR ACTIVE MCPJ FLEXION

– TENDON TRANSFERS
– ACTIVE TENODESIS

ALL MUST PASS VOLAR TO INTERMETACARPAL LIGAMENT
ACTIVE MCPJ FLEXION

TRANSFER TENDON INTO LATERAL BANDS OR BURKHALTER INSERTION PROX PHALANX

- EIP, EDQ TRANSFER (BUNNELL, FOWLER)
- ECRB + PLANTARIS (BRAND)
- FDS (STILES-BUNNELL)
BRAND TRANSFER
PERSONAL

MODIFIED STILES-BUNNELL TO PROXIMAL PHALANX

- CORRECTS CLAW
- PROVIDES MCPJ FLEXION – IPJ EXTENSION
- DOES NOT IMPROVE STRENGTH
- NOT INDICATED IN HIGH ULNAR/MEDIAN PALSY OR POSITIVE BOUVIER SIGN
“IF YOU BECOME A TEACHER, BY YOUR PUPILS YOU’LL BE TAUGHT”

OSCAR HAMMERSTEIN II -- THE KING AND I
ESTABLISH A CLOSE WORKING RELATIONSHIP WITH YOUR SURGEONS

ENHANCE COMMUNICATION

POSTOP PLANNING
WE ARE ALL TEACHERS
WE ARE ALL STUDENTS
PATIENTS LOOK TO YOU FOR EDUCATION AND GUIDANCE
“GOOD, BETTER, BEST, NEVER LET THEM REST, UNTIL THEIR GOOD IS BETTER, AND THEIR BETTER BEST”

ROBERT CARROLL
STIMULATE YOUR PATIENTS THROUGH EDUCATION
TREAT ALL PATIENTS WITH DIGNITY
LEARN PRINCIPLES
RATHER THAN
COOKBOOK
A MIND THAT
GRASPS
PRINCIPLES WILL
DEVISE ITS OWN
TREATMENT PLAN
TRANSCEND BOREDOM WITH ENTHUSIASM
DO WHAT YOU LOVE AND LOVE WHAT YOU DO
THANK YOU