TENDON CONTRACTURES OF THE HAND
OVERVIEW

- Anatomy of the extensor mechanism
- Definitions
- Causes
- Diagnosis
- Treatment
ANATOMY
EXTENSOR SYSTEM:

EXTRINSICS

INTRINSICS
EXTRINSIC EXTENSOR SYSTEM

- radially innervated
- originates in the forearm
- three insertions:
  - MP joint volar plate
  - dorsal of middle and distal phalanx
- extends three joints
EXTRINSIC EXTENSOR SYSTEM

- Extensor digitorum comunis
- Extensor digiti indicis
- Extensor digiti quinti
- Extensor pollicis longus
- Extensor pollicis brevis
- Abductor pollicis longus
EXTRINSIC TENDONS
INTRINSIC EXTENSOR SYSTEM

- ulnarly innervated
- originates in the hand
- arborizes and interrelate with extrinsic system
- flex MP joints
- extends IP joints
INTRINSIC SYSTEM

- dorsal interosseous (4)
- volar interosseous (3)
- lumbricals (4)

- abductor digiti quinti
- flexor digiti quinti
- opponens digiti quinti

- abductor pollicis brevis
- flexor pollicis brevis
- opponens pollicis brevis
- adductor pollicis
INTRINSIC EXTENSOR SYSTEM
DORSAL INTEROSSEOUS MUSCLES
DORSAL INTEROSSEOUS

- 2 MUSCLES HEADS
- SUPERFICIAL
- MEDIAL
- LATERAL
- 2 TENDONS

VOLAR INTEROSSEOUS

- 1 MUSCLE HEAD
- DEEP
- 1 TENDON
Abductor Digit Minimi
Flexor Digit Minimi
THE DORSAL EXTENSOR APONEUROSIS
LUMBRICALS

- Arise from radial side of FDP
- Small but functionally vigorous
- Extend PIP and DIP joint via radial lateral band / mildly flex MP joint
- Ring and small lumbricales are bipennate
TRIANGULAR LIGAMENT
INTRINSIC TIGHTNESS
DEFINITION

Condition in which the contracture of the intrinsic muscles (interossei) of the hand impairs the flexion of the PIP joints and, in severe cases, the extension of MP joints.
CAUSES

- Trauma (edema, prolonged immobilization, muscle ischemia)
  - Early
  - Late
  - Late and severe
- Central nervous system disease (spasticity)
- Systemic connective disease (rheumatoid arthritis)
- Mallet finger
DIAGNOSIS

• Far more common than generally appreciated
• Suspect whenever a deficit of active digital flexion or MP joint extension is encountered
• Complain: weakness when grasping large objects
• Intrinsic tightness test: stiffness of PIP joint flexion when MP joint is held in extension
INTRINSIC TIGHTNESS TEST
INTRINSIC TIGHTNESS TEST

Ricardo Finochietto, (1920)

INTRINSIC TIGHTNESS TEST
INTRINSIC TIGHTNESS TEST

PITFALLS:

- fixed contractures of MP and PIP joints
- painful and subluxated joints
- simultaneous intrinsic and extrinsic tightness
GRIP STRENGTH
CAUSES

• Trauma
  – Early
  – Late
  – Late and severe

• Central nervous system disease (spasticity)

• Systemic connective disease (rheumatoid arthritis)

• Mallet finger
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

TRAUMA

ISCHEMIA

EDEMA
HEMATOMA

FIBROSIS

PAIN
IMMOBILITY

CONTRACTURE
COMPARTMENT SYNDROME
INTRINSIC FASCIO TOMY
CAUSES

• Trauma
  – Early
  – Late
• Central nervous system disease (spasticity)
• Systemic connective disease (rheumatoid arthritis)
• Mallet finger
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

• MILD
• MODERATE
• SEVERE
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

MILD

- Weakness to flex PIP joint
- Treatment: physical therapy
  - ↓ edema
  - stretching
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

MODERATE

- Failed physical therapy
- Possible PIP joint fixed contractures
- Treatment:
  - distal intrinsic release
  - intensive therapy postoperatively
DISTAL INTRINSIC RELEASE

- second chance to improve in a therapy program
- deferred until all edema, inflammation and discomfort have resolved
- release of oblique fibers of the lateral band
- distal to the transverse (flexor) fibers
CAUSES

• Trauma
  – Early
  – Late
  – Late and severe
• Central nervous system disease (spasticity)
• Systemic connective disease (rheumatoid arthritis)
• Mallet finger
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

SEVERE

- uncommon
- subsequent to myonecrosis of interossei
- flexion contracture of MP joint and severe PIP joint extension contracture
- DIP joint flexion contracture
- Treatment: surgical release
POST-TRAUMATIC INTEROSSEOUS CONTRACTURE

SEVERE

• Surgical treatment:
  • proximal intrinsic release
  • possible volar MP capsulectomy and dorsal PIP capsulectomy
  • Z-plasty or transpositional flap of 1st web space
  • Intensive postoperatively physical therapy
  • CPM may be helpful
PROXIMAL INTRINSIC RELEASE
PROXIMAL INTRINSIC RELEASE
SKIN RELEASE
FIRST WEB SPACE Z-PLASTY
CAUSES

- Trauma
  - Early
  - Late
  - Late and severe
- Central nervous system disease (spasticity)
- Systemic connective disease (rheumatoid arthritis)
- Mallet finger
CENTRAL NERVOUS SYSTEM DISEASE

- Cerebrovascular accident (strokes)
- Cerebral palsy
- Upper motor neuron diseases
CENTRAL NERVOUS SYSTEM DISEASE

- Any condition that leads to SPASTICITY
- Not apparent when extrinsic muscles spastic
- Hand assumes an intrinsic-plus position several weeks after release of extrinsic muscles
- Two groups:
  - with cognitive control
  - without cognitive control
SPASTICITY WITH COGNITIVE CONTROL

- treatment goal: relax or weaken the tightened muscles
- May be achieved by INTEROSSEOUS SLIDE
- Patients typically do no have fixed joint contractures
- IT test is negative after anesthesia
- Adductor pollicis longus may require release
- Postoperative splinting for 15 to 21 days in intrinsic minus position
INTEROSSEOUS SLIDE
INTEROSSEOUS SLIDE
SPASTICITY WITHOUT COGNITIVE CONTROL

• No reasonable cognitive control
• Spasticity so severe that lengthening is unlikely to succeed
• Ulnar motor neurectomy
SYSTEMIC CONECTIVE DISEASES

- Reumathoid arthritis
- Dermatomyositis
- Polyarteritis
- Lupus
SYSTEMIC CONNECTIVE DISEASES

- Intrinsic Contracture
  - Perivascular Inflammation
  - Synovitis
SYSTEMIC CONNECTIVE DISEASES

SYNOVITIS

Stretching of collateral ligaments and sagittal bands

MP JOINT INSTABILITY

MP JOINT DISLOCATION

MP JOINT ROTATION X TRANSLOCATION

INTRINSIC SHORTENNING
SYSTEMIC CONECTIVE DISEASES
SYSTEMIC CONNECTIVE DISEASES

- IT test + only when MP joint is reduced and radially deviated
- Treatment:
  - arthroplasty (with shortening)
  - crossed intrinsic transfer
REUMATHOID ARTHRITIS
REUMATOID ARTHRITIS
REUMATHOID ARTHRITIS
SWAN NECK DEFORMITY IN RHEUMATOID HAND

- **Extrinsic tightness:**
  - MP joint subluxated $\rightarrow$ extrinsic tendon tightened $\rightarrow$
  - ↑ tension of central slip

- **Intrinsic tightness**

- **Extrinsic and intrinsic tightness**

- **Other causes:**
  - PIP joint synovitis $\rightarrow$ weakness of volar plate
  - rupture of FDS
  - rupture of terminal tendon (mallet finger)
SWAN NECK DEFORMITY IN RHEUMATOID HAND

• **Intrinsic tenodesis:**
  – release of contracture
  – support of volar side of PIP joint
  – lateral stability to replace collateral ligaments if they require transection
INTRINSIC TENODESIS

REROUTED VOLAR TO CLELAND’S LIGAMENT
INTRINSIC TENODESIS

REROUTED VOLAR TO CLELAND’S LIGAMENT
INTRINSIC TENODESESIS
SWAN NECK DEFORMITY IN RHEUMATOID HAND

- Spiral oblique retinacular ligament (SORL) reconstruction:
  - indicated whenever Cleland’s ligaments are weak and thin
  - tendon graft is sutured to terminal tendon and spiraled around the radial/ulnar side of the finger and fixed to the neck of proximal phalanx.
SPIRAL OBLIQUE RETINACULAR LIGAMENT RECONSTRUCTION
TERMINAL EXTENSOR INJURY

- Conjoined lateral bands retract proximally
- Tensile force of dorsal aponeurosis is no longer distributed to both interphalangeal joints
- Intrinsic tightness usually predominates
- IT test +
- Treatment: SORL reconstruction addresses both problems (DIP and PIP joints)
LUMBRICAL PLUS
(ISOLATED LUMBRICAL CONTRACTURE)
DEFINITION

Condition in which there is an insufficiency of the FDP distal to the lumbrical insertion that promotes extension of the IP joints through the lumbrical muscles when the FDP muscles contracts.
(1) Scarring of the lumbrical (flexor transection)

(2) FDP disruption
   - untreated tendon laceration
   - long tendon graft
   - distal joint amputation
LUMBRICAL PLUS

LUMBRICAL MUSCLE

Relaxed

Contracted

FDP
LUMBRICAL PLUS

PARADOXICAL EXTENSION
LUMBRICAL PLUS

Severance of Flexor Digitorum Profundus

LUMBRICAL PLUS

Avulsion of Flexor Digitorum Profundus

LUMBRICAL PLUS

Overlong flexor tendon graft

Amputation through middle phalanx

Amputation: intrinsic test + → distal intrinsic release

LUMBRICAL PLUS

- Less common in the index finger because of the isolated action of FDP. The patient contracts the FDS and avoids contracting the FDP.

- Treatment:
  - distal intrinsic release
  - lumbrical division in the palm (avoid in the index and middle finger in case of ulnar nerve palsy)
EXTRINSIC TIGHTNESS
DEFINITION

Condition in which there is such tension of extensor hood mechanism that simultaneous, complete flexion of the MP and IP joints is impossible.
EXTRINSIC TIGHTNESS

CAUSES:

- Fibrosis and loss of muscle elasticity in the forearm
- Adhesions of extensor tendons
  - under the extensor retinaculum (wrist)
  - over the dorsum of the hand
- Loss of substance or cicatrix of either the central slip or sagittal band.
EXTRINSIC TIGHTNESS

- Metacarpal fracture
- Extensive soft tissue injury to the dorsum of the hand
- Following extensor tendon repair
EXTRINSIC TIGHTNESS
EXTRINSIC TIGHTNESS
EXTRINSIC TIGHTNESS

Full flexion of the MP joint compels the IP joints to extend.
EXTRINSIC TIGHTNESS

IP joint flexion compels MP joints to extend.
EXTRINSIC TIGHTNESS

- MP flexion requires excursion of up to 10 mm
- IP flexion adds an additional 4 mm to this excursion
- Therefore only a few millimeters loss of stretch can initiate extensor plus state.

EXTRINSIC TIGHTNESS

TREATMENT:

(1) Physical therapy:
   • exercises
   • static or dynamic splinting

(2) Tenolysis

(3) Extrinsic tendon release
   • extensive scarring
   • tendon too short
EXTRINSIC TIGHTNESS

EXTRINSIC TENDON RELEASE:


- Predicated on separation of the intrinsic and extrinsic systems.
- Contraindicated in hands with weak or absent intrinsic musculotendinous function.
EXTRINSIC TENDON RELEASE

Window feels with a pseudotendon scar in 8 weeks.

preserve sagittal bands

preserve distal 5 to 8 mm
EXTRINSIC TENOTOMY

EXTRINSIC TENDON RELEASE

- Procedure best done under digital block anesthesia.
- Postoperative: gentle active assisted exercises.
- Observe developing of boutonnière deformity in the first 8 weeks – splint as needed
SYNDROME OF THE QUADRIGA

PROFUNDUS TENDON BLOCKAGE
SYNDROME OF THE QUADRIGA


• Describe imbalance that occurs when the FDP is advanced and sewn to the extensor over the end of an amputation stump.
• Analogy to that of a Roman charioteer guiding four horses with interconnected reins.
• Profundus tendon “blocage”
SYNDROME OF THE QUADRIGA

FIBROMEMBRANOUS RETINACULUM
SYNDROME OF THE QUADRIGA
SYNDROME OF THE QUADRIGA

Early active ROM of the intact fingers immediately after surgery will prevent the adherence.
SYNDROME OF THE QUADRIGA

• Weak grip with small-handled objects
• Inability to fully clench fist
• Cramping pain in wrist or forearm with strong grip
• Full DIP flexion and power when PIP and MP are extended
• Reduced flexion and power when PIP and MP are flexed
SYNDROME OF THE QUADRIGA

Grade I: DIP full flexion, reduced strength
Grade II: DIP reduced flexion and strength
Grade III: absent DIP flexion

(PIP reduced flexion in small finger when FDS is weak or absent)

SYNDROME OF THE QUADRIGA

TREATMENT:

• Surgical release of FDP in palm and separation from FDS
• Ensure free gliding of the tendon in carpal tunnel: excise a segment of FDP (near the origin of lumbrical) if necessary
• Divide the lumbrical m. if PIP is functioning to prevent lumbrical-plus syndrome
SYNDROME OF THE QUADRIGA
SYNDROME OF THE QUADRIGA
SYNDROME OF THE QUADRIGA