Current Practice in Tendon Management

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~ Handout ~
www.indianahandtoshoulder.com
Click on Therapy → Flexor Tendons – Denver
Handouts – talk & patient handouts

Topics
- Indiana Early Motion Program
  - Rationale for the place & hold exercise
- Case Examples

Indiana Early Motion Program
Initiated 25 Years Ago
- Modified Duran (PROM) + Place & Hold (AROM)

Candidates for the Program
- Surgical Procedure
  - ≥ 4 strand repair (profundus)
- Select Patients
  - Understand & will adhere to the program & the precautions [surgeon/therapist clinical judgment]
- Postoperatively
  - Digits passively supple
  - Limited edema (7mm or less than digit opposite hand)

Modified Duran Program
- Initiated 3-5-7 Days Postop
  - Edema begins to plateau
  - Work of flexion & gliding resistance begin to ↓ [Manske, Amadio, Tang...]
- 2-3 Days Later – Add Place & Hold Exercise
**Place & Hold Exercise**

- **1st Stage**
  - Passive digital flexion combined with passive & active wrist extension

- **2nd Stage**
  - Active hold

- **3rd Stage**
  - Dropping the wrist into flexion

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**Rationale – Place & Hold Exercise**

- **Resistance - Profundus**

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**Active Flexion**

- **Evans & Thompson** [JHT 1993]
  - Short arc motion = 3N (FDP)
  - Full arc motion = 9N (FDP)

- **Greenwald et.al** [JHS 1994]
  - Light fist (active extension/flexion) 4N – 9N (FDP)

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**Place & Hold Exercise**

- **Extensive Research (over 25 years ago)**
  - Literature – Lab – Clinical Studies → Patients

- **Stronger Repair**
  - 4 strand + peripheral running suture (+ 47N)

- **Therapy Program**
  - Prioritized addressing all factors ↑ WOF → minimize resistance on the profundus
  - Synergistic place & active hold exercise (< 10N)
Place & Hold Exercise

- Edsfeldt, Kursa et al. [JHS European Sept. 2015]
- Patients with CTR
- In vivo flexor tendon forces generated during different rehabilitation exercises

- Light fist 6.5N (FDP)
- Place & hold 3.6N (FDP)
- Force ↑ with repair & factors ↑ WOF

Factors ↑ Work of Flexion (WOF)

- Pulleys
- Edema
- Extrinsic Extensors
- Joint Stiffness

Indiana Program
Factors Favorably ↓ WOF

- Edema
  - Bulky not removed until 3 – 5 – 7 days postop
- Joint Stiffness
  - PROM program precedes AROM by 2 – 3 days
  - Combined program – passive before active
- Extrinsic Extensors
  - Wrist – extended with active flexion
- Tendon Resistance through the Pulleys
  - Venting the pulleys &/or excision slip of FDS

Active Flexion...Stay in the Safe Zone

- 4 Strand Repair 40N

Calculation (N) – Flexion

- Place & Hold Exercise 3.6N (FDP)
- Repair + 1.1N
- Edema ≤ 1cm + 1.8N
  - ↓ 30% to 50% [PROM] - .6N
- Joint Stiffness ---
- Extrinsic Extensors ---
- Estimated Total 5.9N

Calculation (N) – Repair

ADD
- Repair Type 2-4-6 strand 40N
- Peripheral Repair (minimum) 7N

SUBTRACT
- Initial Tendon Softening 10%-20% - 8N
- Repair Strength 30% - 12N
- 2mm Gapping
- Net: 27N
**Know the Repair Strength**

- 2 Strand → 20N
- 4 Strand → 40N
- 6 Strand → 60N
- Button → 45N
- Anchor → Micro 70N
- Anchor → Mini 45N
- Simple Peripheral Running Suture → 7N
- 3-0 vs 4-0 Suture → 10N – 15N

**Case Examples**

**Clinical Experience**

- FDP (6 strand) repair – Zone II
- FDP repair micro anchors – Zone I
- FDS/P (4 strand) repair – Zone II
- FDS/P (6 strand) repair – Zone II
- FDS/P repairs (6 strand) middle and ring – Zone II

**Case Example [A.F.]**

- 13 y/o Girl; Fell & Cut Finger on Glass Table
- DOI: 6/15/15 Left Middle Finger
- Profundus Laceration thru A3 pulley [zone II]
- Surgery [9 days post injury]
  - Six strand repair – 3-0 Supramid suture
  - Peripheral epitendinous repair
  - Therapy [5 days post surgery]
    - Indiana Early Motion Program

**Determine the Repair Strength**

- 6 Strand → 60N
- 3-0 Supramid Suture → 10 - 15N
- Peripheral Epitendinous Repair → 7N + 77 N*

*Does not account for:
- Factors that ↑ the work of flexion (WOF)
- Initial tendon softening ↓ 20% (max)
- Potential gapping at the repair site ↓ 30% (max)

**Therapy**

**5 Days Postop**
- Dorsal Blocking – PROM

**7 Days Postop**
- Tenodesis – Place & Hold

**Weeks 1 – 3**

**Limited Participation in Therapy Initially**

**ROM: 1st Wk 2nd Wk 3rd Wk**

- MP x/75 x/75 x/80
- PIP x/95 x/95 x/95
- DIP x/35 x/30 x/30

Hand to Shoulder Therapy Center
CPR... *Resuscitate Tendon Gliding!*

- Change the Therapy Program!
- Give her a Chance... *Tendon Pull Through!*

**Treatment Program “Modifications”**

- Advanced Therapy Program by a Week
  - Out of orthoses – active motion at 3 weeks
  - Added blocking orthoses – exercise at 5 weeks
  - Discontinued dorsal blocking orthosis at 5 weeks
  - Began resistance at 6 weeks
    - Foam piece (cylinder shape)
    - Putty
    - Hand exerciser

**Out of Orthoses**

- Set Goals – Active Flexion
  - Markings in the palm

**Blocking Orthoses - Exercise**

- Buddy Tapes
  - 4 weeks postop
- Hand Based MPJ Block
  - 5 weeks postop

**Blocking Orthosis – 6 Weeks Postop**

- Oval 8
  - All day

**Oval 8 Orthosis**

- Wore throughout the Day
7 Weeks Postop
- Increase Tendon Gliding
  - Putty & hand exerciser

Outcome – 11 Weeks Postop
- ROM - Left Middle Finger
  - MP 0/90
  - PIP 0/110
  - DIP 0/55 [65] blocked motion

Discharge Visit – 3 Months
- ROM – Left Middle Finger

Case Example [J.S.]
- 22 y/o Male; Cut Hand with Knife at Work
- Right Middle Finger – FDP Zone I & RDN
- Surgery [4 days post injury]
  - FDP advancement – micro anchors [70N]
  - RDN repair
- Therapy
  - Indiana Early Motion Program

Therapy
- 6 Days Postop
  - Dorsal Blocking – PROM
- 9 Days Postop
  - Tenodesis – Place & Hold

Primary Challenge
- Wound Closure
  - Persistent drainage

Hand to Shoulder
Therapy Center
Treatment Program “Modifications”

- MP Joint Blocking Orthosis [6wks]
- Ultrasound [7 wks]
  - Proximal phalanx
- Safety Pin Splint [8 wks]
  - 3-4 times a day 30 min.

Outcome – 3 Months

- MP: 0/95
- PIP: 5(0)/110
- DIP: 10(5)/60

Outcome

- Right Middle Finger
  - FDP Advancement with Suture Anchors

Patient Video...

- ASSH Annual Meeting 2015
- Indiana Early Motion Program

Case Example [K.W.]

- 15 y/o Female; Cut Hand with a Knife
- DOI: 5/10/15
- Lacerated Left Index Finger
  - FDS/FDP & RDN Zone II
- Surgery [8 days later]
- Repair FDS/FDP & RDN
  - Profundus repair: 4 strand + peripheral epitendinous repair [47N]

Therapy

- 4 Visits
  - 1st month of therapy
  - Preferred minimal medical intervention
- Home Program
  - Patient handouts
  - Phone calls
  - Text messages
**Treatment Program “Modifications”**

- **5 Weeks Postop**
  - Discontinued DBO; transitioned to buddy tapes
  - Passive PIPJ extension with the MP flexed

**Outcome – 8 Weeks Postop**

- **Pictures – Texted!**

**Current Outcome – 4 Months Postop**

**Outcomes – Early Active Program**

- **Trumble et al. JBJS 2010**
  - Zone-II Flexor Tendon Repair: A Randomized Prospective Trial of Active Place-and-Hold Therapy Compared with Passive Motion Therapy
  - Modified Duran/Place & Hold Program
  - 54 Patients
  - 6 weeks po
  - 1 year postop
  - TAM: PIPJ & DIPJ = 122° and 156°
  - Rupture rate: 3.8%

**Program Changes**

- **Gradually Eliminating Tenodesis Orthosis**
  - Zone I & II Repairs
  - Partial repairs, buttons, anchors
  - Easier to perform modified synergistic exercise
- **6-Strand Repairs**
  - Moving ahead of 4-strand repair program by one week (frequently)
  - Out of the DBO – 5 weeks po

**Modified Synergistic Exercise**

- **Amadio**
  - 1.7 N tension on the repair & passive glide - FDP
  - Differential tendon gliding
  - Allows distal glide of the profundus
**Early Motion Programs**

- Essential to Know the Repair Strength
  - Establish optimal treatment program
- Comfortable Imparting the Necessary Passive & Active Motion
- Prioritize Addressing Factors Impact WOF
- Adjust Program – Limited Tendon Gliding

**Have Fun Treating Flexor Tendons!**

*Enjoy Denver... Enjoy the Meeting!*