Role of Interosseous/Lumbrical Muscle Shortening in Finger Stiffness

Judy C. Colditz, OT/L, CHT, FAOTA

Point 1:
- Dorsal & volar interosseous muscles do the same thing most of the time!
- Rotation at MP Joint

- Rotation
  - With MP flexion, deviators become rotators

- PIP extension
  - Oblique fibers
  - Best with MP extended

- Transverse Fibers
**MP JOINT FLEXION**

- Transverse Fibers
  - Flex MP joint

**MP JOINT FLEXION**

- Most powerful at end range of MP flexion

**INTEROSSEOUS MUSCLES**

- Dorsal & Volar Interosseous Muscles
  - Opposite
    - Adduction & abduction
  - Identical
    - MP joint flexion
    - IP joint extension, PIP > DIP
    - Proximal phalanx rotation

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INTEROSSEOUS MUSCLES

- Primary MP joint flexors
  - No other muscle is primary

THE TEST

- Finochietto, 1920
  - Interosseous Tightness Test
  - Does not test Lumbrical tightness

Point 2:
- There is no such thing as the INTRINSIC TIGHTNESS TEST!

INTEROSSEOUS TIGHTNESS TEST

- Limited finger flexion
  - Interosseous muscle must elongate during finger flexion
INTEROSSEOUS MUST LENGTHEN

- Muscle Relaxed
  - Longest length

- Muscle Relaxed
  - Next longest length

INTEROSSEOUS TIGHTNESS TEST

The question
- Is there less passive PIP flexion with MP extended than with it flexed
  - YES or NO

INTEROSSEOUS TIGHTNESS TEST

1. Passive PIP flexion with MP flexed

2. Passive PIP flexion with MP hyperextended

- The DIP joint is NOT included
INTEROSSEOUS TIGHTNESS TEST

- Look at normal (uninjured) side
  - Maximum PIP flexion with MP hyperextension

NORMAL HAND (each finger)
Step 1.

What is the max MP hyperextension with max PIP flexion?
INTEROSSEOUS TIGHTNESS TEST

INJURED HAND (each finger)
Is passive PIP flexion LESS when the MP joint is extended?

YES  NO

INJURED HAND (each finger)
Step 2.

INTEROSSEOUS TIGHTNESS TEST

?°

INJURED HAND (each finger)
Step 3.

• Less PIP flexion?

INTEROSSEOUS TIGHTNESS TEST

?°

INJURED HAND (each finger)
Step 2.

INTEROSSEOUS TIGHTNESS TEST

• Important
  1. Neutral finger alignment
  2. Accurate MP hyperextension
  3. Exclude DIP joint

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Point 3:
- You can quantify INTEROSSEOUS MUSCLE TIGHTNESS

 Reminder:
- Must first answer question:
  • Is passive PIP flexion LESS when the MP joint is extended?

☑ YES  □ NO

QUANTIFYING TIGHTNESS

1. + 2. = Interosseous Muscle Elasticity Score

NORMAL HAND
(each finger)
Step 1.

122° + 28° = 150
(Normal Interosseous Muscle Elasticity Score)
NOTE: 28° is maximum MP joint hyperextension

INJURED HAND (each finger)
Step 1.

• Less PIP flexion?
  YES (normal = 84°)

INJURED HAND (each finger)
Step 2.

72° + 28° = 100
Interosseous Muscle Elasticity Score

INJURED HAND (each finger)
Step 3.

MP: same as uninjured maximum

INJURED HAND (each finger)
Step 4.

MP: same as uninjured maximum

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Injured finger has 67% of normal interosseous muscle elasticity.

Individual Finger Score Formula:

\[
\text{Injured Score} \div \text{Normal Score} = \% \text{ of normal interosseous muscle elasticity}
\]

Active Motion

Extension

Flexion

Patent Example

Step 1.

UNINJURED contra-lateral finger

110°

+17°
Normal Interosseous Muscle Elasticity (contra-lateral finger)

110° + 17° = 127°

PIP flexion + MP hyperextension

INJURED finger
Step 2.

74°

INJURED finger
Step 3.

Is passive PIP flexion LESS when MP joint is extended?
- (68° vs 74°)

YES
Injured Finger: Interosseous Muscle Elasticity Score

\[68^\circ + 8^\circ = (\text{Total: 76})\]

(Normal is \(110^\circ + 17^\circ = 127\))

\[
\frac{76}{127} = 60\% \text{ (59.8) of normal interosseous muscle elasticity}
\]

Point 4:
- You can test for LUMBRICAL MUSCLE TIGHTNESS
LUMBRICAL MUSCLE FUNCTION

- Finger Extension
  - Profundus relaxed
  - Lumbrical contracted

MEAN RESTING FIBER LENGTHS

<table>
<thead>
<tr>
<th>Muscle Type</th>
<th>Mean Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal Interossei (excluding 1st)</td>
<td>1.46 cm</td>
</tr>
<tr>
<td>Volar Interossei</td>
<td>1.57 cm</td>
</tr>
<tr>
<td>Lumbricals</td>
<td>5.75 cm</td>
</tr>
</tbody>
</table>

Muscle excursion equivalent to extrinsic muscles

Brand & Hollister, 1999
Yu, Chase & Strauch, 2000

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LUMBRICAL MUSCLE FUNCTION

- Finger Flexion
  - Profundus contracted
  - Lumbrical relaxed

LUMBRICAL MUSCLE

- IP Joint Extension
  - Lumbrical muscle most directly influences the DIP joint

Lumbral Muscle Length

Bunnell, 1957
Tabara, 1981

LUMBRICAL MUSCLE FUNCTION

Direct to DIP: influences entire dorsal hood

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TESTING LUMBRICAL TIGHTNESS

- Requires active FDP pull

RESOLVING LUMBRICAL TIGHTNESS

- Active Hook: max lumbrical elongation
- Requires MP block with ACTIVE flexion

LUMBRICAL MUSCLE TIGHTNESS

Observational Test
- Inability to fully flex fingertips
  - Passive motion greater
- Paradoxical DIP extension at end range

Active Redirection instead of PROM for Finger Stiffness

Judy C. Colditz, OT/L, CHT, FAOTA
- New belief
  - Active motion can increase passive motion
ICAM (Immediate Controlled Active Motion)
- Relative Motion Orthosis
- Yoke Orthosis
- Merritt Orthosis

Howell et al. 2005

HandLab, 2017
- Example
  - Increased participation by the lateral bands

- Directing FDP power to IP joints
  - Mobilizing joints
  - Elongating interosseous muscles
ACTIVE REDIRECTION

Orthosis
- Only one direction
- Edema increased?
- No cortical change

Active Redirection
- Differential glide
- Edema reduced
- Cortical re-mapping

ADDITIONAL INFORMATION:
Articles, Clinical Pearls, & Video Courses

www.HandLab.com