Fundamentals of Needle Guidance and Tenotomy

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Technique:
• In plane approach
  – Long axis of needle along long axis of transducer
  – See entire needle including tip
  – Most accurate

In Plane Approach

Technique:
• Out of Plane Strategy
• “OOPS”
• Short axis of needle crosses ultrasound beam
• Less accurate
• US: could represent needle shaft or tip

Out of Plane Approach

Superficial joints: AC, SI, CMC, MCP, PIP, DIP
Technique: curved surface
- More room to work
- Puncture site away from transducer
- Access tendon sheath in short axis
- Needle perpendicular to sound beam

Preferred Technique:
- Direct:
  - “X” marks puncture site
  - “---” marks plane for transducer and needle
- Indirect:
  - Paperclip technique

Technique:
- Cleanse: ChloraPrep
  - 70% alcohol, 2% Chlorhexidine
- Sterile drapes
- Sterile ultrasound cover
- Local anesthetic
  1% Lidocaine

Technique:
- Ergonomics
  - Patient laying in front
  - Monitor beyond
    - Left hand seen at left side of monitor
  - Secondary monitor
  - Chair

Technique: free hand
- Insert needle 1 cm into soft tissues
- Find needle by moving transducer
- Elongate needle in long axis to see entirety to tip
- Advance needle under visualization
Technique: guidance
• DO NOT advance needle unless completely seen longitudinally to tip
• DO NOT move transducer and needle at same time

Needle Visualization
• Large needle
• Coated needle
• “Jiggle” the needle
• Rotate needle: bevel
• Needle perpendicular to sound beam

Needle Anisotropy: 20-gauge
Oblique
Perpendicular

Needle Orientation
Beam Steering

Normal

With Beam Steering

Sterile Gel Standoff

- Lift distal transducer off skin
- Thick layer of sterile gel between transducer and probe
- Superficial targets
- See needle prior to entering skin and target

Beam Steering

Tendon Fenestration

- Also called “dry-needling” or tenotomy
- Needle repeatedly passed through areas of tendinosis
- Disrupts area of tendinosis
- Bleeding causes release of growth factors
- Stimulates tendon healing

Fenestration: technique

- No NSAIDS x 10 days prior
- Ultrasound guidance: in plane
  - Long axis to tendon
- 20 or 22 gauge needle
- 20 – 30 passes until area soft
- Minimal Lidocaine: over tendon

Percutaneous Fenestration

Non-sterile technique for simulation only!

- 20 or 22-gauge needle
- 20 to 30 needle passes
- Continued until area covered and tendon softens

Fenestration: technique

- Cover entire tendon abnormality
- Contact bone if at tendon abnormality
- Pull needle out of tendon to redirect
- Also redirect medial to lateral
  - Pivoting at needle entrance
  - Cone-shaped area
**Fenestration: technique**

- Contraindications:
  - Not delineated in literature
  - Prior steroid injection < 3 months ago
  - Bleeding disorders
  - Infection
  - Tendon tear > 50% thickness?

**Post-procedure:**

- Rest for 2 weeks
  - Daily activities okay
  - Gradual return to activities

- Follow-up:
  - Referring physician, physical therapy

- No NSAIDS: 2 weeks

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**Phases of Tissue Healing**

![Diagram of tissue healing phases](From: Lee KS, et al. Am J Roentgenol 2011; 196:628)

**Post-procedure:**

- Patellar tendon:
  - Knee brace (locked) x 2 weeks
  - First week non-weight bearing with crutches
  - Nothing?

- Achilles tendon:
  - Walking boot x 2 weeks

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**Patellar Tendon**

- Randomized controlled: 23 patients
- PRP + fenestration versus fenestration alone
- PRP outcomes better at 12 weeks
- No significant difference in outcomes when greater than 26 weeks


**Patellar Tendon**

- 45 tendons
- 76% improved at 4 weeks, 24% no change
- Improved outcome at 4 weeks if:
  - Less pain prior to procedure
  - Well-defined area of tendinosis at US
  - No correlation with other ultrasound findings (color, size, location, etc.)

Common Extensor Tendon: elbow

- 58 patients\(^1\)
- Outcome: average 28 months
  - Pain level and difficulties with related activities
  - 64% excellent, 16% good, 7% fair, 13% poor
  - No adverse effects
- Follow-up study: 57 patients\(^2\)
  - 93% excellent or good results
  - Corticosteroid injection not needed

\(^1\)McShane JM et al. J Ultrasound Med 2006; 25:1281
\(^2\)McShane JM et al. J Ultrasound Med 2008; 27:1137

Randomized controlled: 230 patients
- PRP + fenestration versus fenestration alone
- No difference in outcomes at 12 weeks
- Significant difference in pain scores at 24 weeks: PRP group had less pain


Randomized controlled: 28 patients
- PRP + fenestration versus fenestration alone
- Trend for greater clinical improvement in PRP subjects at 2 months
- No difference in clinical outcome at 6 months

Stenhouse G et al. Skeletal Radiol 2013; 42:1515

Fenestration: pelvis

- 22 tendons in 21 patients
- Gluteus medius (11), hamstring (8),
  gluteus minimus (2), tensor fascia lata (1)
- Marked or some improvement: 82%

Gluteus Maximus and Minimus

- Randomized controlled: 30 patients
- PRP versus fenestration alone
- Significant improvement at weeks 1 and 2
- Approximately 80% had long term improvement: up to 1 year follow-up
- No difference between treatment groups


Take Home Points

- Technique:
  - In plane: most accurate
  - Initially insert needle short distance
  - Visualize needle in long axis
  - Rotate transducer to visualize target
  - Then move needle into plane
  - Must see entire needle to tip before advancing

Take Home Points

- Tenotomy:
  - Disrupts degenerative process
  - Stimulates healing
  - 75 - 80% improvement
  - Is basis of other tendon injection therapies with similar outcomes

Thank you!

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