Tendinopathy – Evaluation and Management

Troy Henning, DO
Assistant Professor
Dept PM&R University of Michigan
AOCPMR
2014
Goals

- Update on Tendinopathy
  - Terms
  - Prevalence
  - Proposed Etiologies
  - Diagnosis
  - Treatment Approaches
Terms

• Tendonitis: inflammation of tendon

• Tendinosis: histologic term describing degenerative changes within tendon

• Tendinopathy: clinical diagnosis of diseased tendon without reference to etiology
  – preferred term
Epidemiology

- Prevalence
  - Gluteal Tendinopathy
    • 1.8 /1000
  - Patellar Tendinopathy
    • 7 - 40% in athletic population
  - Rotator Cuff Tendinopathy
    • 30-50% age >70
Etiology

**Diagnosis**

- **Clinical Diagnosis**
- **Radiologic Confirmation**
  - Radiographs
    - cortical irregularities/enthesophytes
  - Ultrasound
    - hypoechoic, thickened, clefts/tears
    - Resolution: 150 microns
  - MRI
    - Increased T1 early, T2 signal later stages
    - Resolution: 450 microns
Current Treatment Approaches
Exercise

- **Eccentric Training**
  - Curwin and Stanish 1984 book: jumpers knee
  - Drop Squats
    - increased speed then load, only when pain free
- **Alfredson et al**
  - 1998 mid portion Achilles tendinopathy
    - increased load
    - exercise despite pain
Eccentric Training

- Tendinopathy
  - Mid Portion Achilles
  - Insertional Achilles
  - Patellar Tendon
  - Common Wrist Extensor Tendon
Most modeled after Alfredson et al work
- 3 sets of 15 reps, 1-2x’s daily
- 3 - 7 days/week
- Exercise with mild - moderate discomfort
- Increase load along with decrease pain
Study Outcomes

• General conclusions
  – 60 - 90% improvement
  – Need to remove from offending activity
  – Results start to be seen after 12 weeks of exercise
Topical Glyceril Trinitrate

• NO (nitric oxide)
  – Rat Achilles tendon model
• Inhibition of NOS
  – Reduced tendon CX area
  – Reduced tendon failure load
  – Exogenous NO reversed findings
GTN Patches

• 5mg/24 hour - cut in ½
  – Clinically 0.1 mg/hr nitrodur
    • ½ patch for 2 wks
• Place over painful tendon
• Change patch daily
  – Increase to full patch after 2 wks if needed
GTN vs. Placebo Trial

  - Lateral elbow, Rotator cuff and Achilles tendon
  - 5mg/24hr patch vs. placebo patch
  - Both groups performed “rehab exercises”
    - Decrease in pain (6 wks RTC, 6mon elbow/Achilles)
    - Increased ROM and Power (6months)
Corticosteroid Injections


- 41 trials, 2672 participants
  - 17 lateral elbow, 1 medial elbow, 16 rotator cuff, 7 Achilles, 3 patellar tendon
  - reduced pain in short term (0-12wks), effect reversed at intermediate and long terms, 13-26 wks and >52 wks respectively

Achilles = 2/2
Patella = 5
Glt Med= 1
ITB = 1
Hamstring = 1
Rec Femorsis = 1
Lat Elbow = 1
Lateral Elbow Tenotomy


Table 3. Responses to Questionnaire

<table>
<thead>
<tr>
<th>Task</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turning a can</td>
<td></td>
</tr>
<tr>
<td>Carrying a book</td>
<td></td>
</tr>
<tr>
<td>Lifting a cup</td>
<td></td>
</tr>
<tr>
<td>Opening a bottle</td>
<td></td>
</tr>
<tr>
<td>Wringing a towel</td>
<td></td>
</tr>
<tr>
<td>Vacuuming</td>
<td></td>
</tr>
<tr>
<td>Unloading</td>
<td></td>
</tr>
<tr>
<td>Performing recreation</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Overall Satisfaction (n = 52 Patients)

<table>
<thead>
<tr>
<th>Perception of Overall Outcome</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>30 (57.7)</td>
</tr>
<tr>
<td>Good</td>
<td>18 (34.6)</td>
</tr>
<tr>
<td>Fair</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>Poor</td>
<td>3 (5.8)</td>
</tr>
</tbody>
</table>

Patients were asked to rate the degree of applicable.

Average time to F/U: 22 months
Autologous Blood

Platelet Rich Plasma Injections
ABI and PRP

- Higher concentration platelets and growth factors (VEGF, PDGF, TFG-β1, EGF, IGF)
- ABI: venous blood injected directly into tissue
- PRP: (20-60ml) venous blood spun in centrifuge
  - Collect platelets (2-8x’s blood count)
    - leukocyte rich vs. poor
    - activated vs. non-activated
Basic Science of PRP


Nikolas Baksh, B.S., Charles P. Hannon, B.S., Christopher D. Murawski, B.S., Niall A. Smyth, M.D., and John G. Kennedy, M.D., M.Ch., M.M.Sc., F.R.C.S.(Orth)

31 in-vitro and in-vivo studies

Increased growth factors, tenocyte and extracellular matrix proliferation, increased load to failure

Lack of uniformity in reporting PRP formulation, platelet concentrations and cytology
Current Questions

Does PRP work better than ABI, Tendon Fenestration or Eccentric Exercise?

Is the clinical improvement related to needling of tendon, injectate or exercise or all?
# PRP vs Dry Needling

## Table 3

Net Change in Scores From Baseline to 12 and ≥26 Weeks

<table>
<thead>
<tr>
<th></th>
<th>Change From Baseline at 12 Weeks</th>
<th>Change From Baseline at ≥26 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DN</td>
<td>PRP</td>
</tr>
<tr>
<td></td>
<td>Δ</td>
<td>P</td>
</tr>
<tr>
<td>VISA</td>
<td>13</td>
<td>5.2 ± 12.5</td>
</tr>
<tr>
<td></td>
<td>(−2.2 to 12.6)</td>
<td>(10.3 to 40.6)</td>
</tr>
<tr>
<td>Tegner</td>
<td>1</td>
<td>0.0 ± 1.4</td>
</tr>
<tr>
<td></td>
<td>(−0.9 to 0.8)</td>
<td>(1.0 to 3.0)</td>
</tr>
<tr>
<td>Lysholm</td>
<td>10</td>
<td>26.5 ± 22.7</td>
</tr>
<tr>
<td></td>
<td>(13.2 to 39.9)</td>
<td>(6.2 to 41.4)</td>
</tr>
<tr>
<td>VAS</td>
<td>2</td>
<td>−0.9 ± 2.2</td>
</tr>
<tr>
<td></td>
<td>(−2.2 to 0.4)</td>
<td>(−3.8 to −1.1)</td>
</tr>
<tr>
<td>SF-12</td>
<td>6.8</td>
<td>−0.4 ± 6.0</td>
</tr>
<tr>
<td></td>
<td>(−4.0 to 3.1)</td>
<td>(−0.4 to 3.5)</td>
</tr>
</tbody>
</table>

Values are reported as mean change (Δ) ± standard deviation (95% confidence interval). Statistically significant differences are in boldface. The ≥26-week statistical analyses were performed “per protocol,” which excluded data from the 3 patients who crossed over from the dry needling (DN) to the platelet-rich plasma (PRP) group. MCID, minimum clinically important difference; SF-12, Short Form–12; VAS, visual analog scale; VISA, Victorian Institute of Sports Assessment.

Based on published MCIDs for VISA, Tegner, Lysholm, VAS, and SF-12.
Study Objectives: Determine changes in:
- pain (VAS 0 - 10)
- function (0 = no limitation 10 = severely limited)
- sonographic appearance of the tendon
## Outcomes

**Table 7. Preprocedure, postprocedure, and change in functional limitations and pain (n = 41)**

<table>
<thead>
<tr>
<th></th>
<th>Preprocedure, Mean (range)</th>
<th>Postprocedure, Mean (range)</th>
<th>Pre- to Postprocedure Change, Mean (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst pain*</td>
<td>7.8 (4.0-10.0)</td>
<td>3.3 (0.0-10.0)</td>
<td>-4.5 (-10.0-2.0) P = .0001</td>
</tr>
<tr>
<td>Best pain*</td>
<td>2.5 (0.0-9.0)</td>
<td>0.4 (0.0-4.0)</td>
<td>-2.1 (-9.0-0.0) P = .001</td>
</tr>
<tr>
<td>Average pain*</td>
<td>5.6 (1.0-9.0)</td>
<td>1.5 (0.0-5.0)</td>
<td>-4.1 (-9.0-3.0) P = .001</td>
</tr>
<tr>
<td>Function†</td>
<td>6.2 (0.0-10.0)</td>
<td>2.0 (0.0-9.0)</td>
<td>-4.2 (-10.0-0.0) P = .001</td>
</tr>
</tbody>
</table>

*Ten-point numeric scale (NS): 0 = no pain, 10 = worst pain possible.
†Ten-point NS: 0 = no functional limitations related to tendinopathy, 10 = extremely limited because of tendinopathy.

**Table 8. Preprocedure, postprocedure, and change in sonographic characteristics of the tendinopathy (n = 34)**

<table>
<thead>
<tr>
<th></th>
<th>Preprocedure</th>
<th>Postprocedure</th>
<th>Pre- to Postprocedure Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal thickness in mm, mean (range)</td>
<td>8.4 (4.4-20.0)</td>
<td>7.8 (3.1-22.7)</td>
<td>-0.6 (-5.9-6.6), P = .09</td>
</tr>
<tr>
<td>Length in mm, mean (range)</td>
<td>28.2 (13.0-63.4)</td>
<td>25 (2.6-62.1)</td>
<td>-3.2 (-53.7-7.8), P = .003</td>
</tr>
<tr>
<td>Echotexture*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b = 6 (18%)</td>
<td></td>
<td>1a = 13 (38%)</td>
<td>Improved = 28 (82%)</td>
</tr>
<tr>
<td>1c = 14 (41%)</td>
<td></td>
<td>1b = 17 (50%)</td>
<td>Worsened/no change = 6 (18%) P = .33</td>
</tr>
<tr>
<td>2 = 14 (41%)</td>
<td></td>
<td>1c = 3 (9%)</td>
<td></td>
</tr>
<tr>
<td>2 = 1 (3%)</td>
<td></td>
<td>2 = 1 (3%)</td>
<td></td>
</tr>
<tr>
<td>Intratendinous calcifications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No = 24 (71%)</td>
<td></td>
<td>No = 22 (64%)</td>
<td>Improved = 12 (38%)</td>
</tr>
<tr>
<td>Yes = 10 (29%)</td>
<td></td>
<td>Yes = 12 (36%)</td>
<td>Worsened/no change = 22 (62%) P = .32</td>
</tr>
<tr>
<td>Neovascularity†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 = 18 (52.9%)</td>
<td></td>
<td>0 = 19 (56%)</td>
<td>Improved = 28 (82%)</td>
</tr>
<tr>
<td>1 = 2 (5.9%)</td>
<td></td>
<td>1 = 6 (18%)</td>
<td>Worsened/no change = 6 (18%) P = .31</td>
</tr>
<tr>
<td>2 = 7 (20.6%)</td>
<td></td>
<td>2 = 6 (18%)</td>
<td></td>
</tr>
<tr>
<td>3 = 7 (20.6%)</td>
<td></td>
<td>3 = 3 (8%)</td>
<td></td>
</tr>
</tbody>
</table>

*Echotexture scale: 1a = less than one-third of the tendon is hypoechoic; 1b = one-third to two-thirds of the tendon is hypoechoic; 1c = greater than two-thirds of the tendon is hypoechoic; 2 = partial-thickness tear.
†Neovascularity scale: 0 = no neovessels; 1 = neovessels on the tendon surface; 2 = 1-2 intratendinous neovessels; 3 = ≥ 3 intratendinous neovessels.
Sclerosing Neovessels


- Largest randomized trial to date
- Assessed VISA-P score at 6, 12, 24 months
- Achieved only moderate improvement in pain
High Volume Injections

• Theory: in growth of neovessels and free nerve endings responsible for pain
• High volume injection: hydro dissect/disrupt neovessels and nerves to reduce pain
High volume image guided injections for the management of chronic tendinopathy of the main body of the Achilles tendon

Nicola Maffulli\textsuperscript{a,*}, Filippo Spiezia\textsuperscript{b}, Umile Giuseppe Longo\textsuperscript{b}, Vincenzo Denaro\textsuperscript{b}, Gayle D. Maffulli\textsuperscript{a}

Methods

• Prospective Study, no blinding, no control
  – At least 12 months of pain at mid portion Achilles
    • Athletes, practiced at least 2x/wk
    • Average age: 37.5, 69 male, 25 female
  – All did not respond to prior typical non-op mgmt: EE, ESWT, activity modification, casting, steroid injections
  – 94 initially enrolled, 87 at f/u at 12 months
    • No mention of dropout
  – VISA-A Score primary outcome measure
    • Initial had to be <60
    • Also looked at tendon thickness and grade of neovessels
Injection Protocol

- Ultrasound guided injection (n=94)
  - 10ml 0.5% bupivacaine, 25mg aprotinin, 40ml of normal saline
    - No heavy loading for 72 hours
- Follow up injection (n = 45)
  - 2-6 weeks later
    - Same volume, used 25mg hydrocortisone in place of aprotinin
- All performed supervised eccentric load program
  - No specifics on the program given, unsure if compliance measured
Outcome

- Data available on 87/94 (93%)
- VISA-A
  - Initial: 41.7 ± 23.2
  - 12 months: 74.6 ± 21.4 (p = 0.003)
- Return to play
  - 61 desired level of play
  - 10 lower level
  - 8 could not return
  - 8 had surgery could not return
Take Home Points

• Tendinopathy most common MSK related visit
• Not Age Dependent
• Due to failed healing response
• Majority respond to Eccentric Exercise
• Corticosteroid: temporizing measure
• Nitroglycerin patches should be considered
• Needle Tenotomy/ABI/PRP
  – Possibly equally effective
• Hydro dissection maybe appropriate for patella or Achilles