Tendinopathies in Sports

Introduction

✓ Tendinopathy:
  • Clinical syndrome – often not always implies overuse tendon injuries
  Ackermann & Renstrom: J Sports Health '12
  ✓ Characterized by pain, diffuse or localized swelling & impaired function
    Kahn et al: Clin J Sport Med '98
  ✓ Pain is central factor in tendinopathies
    Kongsagaard et al: JSMSS '11
    Henriksen et al: BJSM '10

✓ Tendinosis:
  ✓ Histopathological finding which includes collagen disorganization, fiber separation, mucoid ground substance, hypercellularity, & nerve / vessel ingrowth – without signs of intra-tendinous inflammation
    Magnusson et al: Nat Rev Rheumatol '10
  ✓ Due to complex nature of tendinopathy is a sign. challenge to Rx by clinicians
    Kongsagaard & Landberg: JSMSS '11

Peritendinitis ← Tendinosis

✓ Tendinosis:
  ✓ Histopathological finding which includes collagen disorganization, fiber separation, mucoid ground substance, hypercellularity, & nerve / vessel ingrowth – without signs of intra-tendinous inflammation
    Magnusson et al: Nat Rev Rheumatol '10
  ✓ Theoretical Overuse injury is a result of mismatch:
    Landberg: JSMSS '07

Mechanical Loading ← Adaptation of Collagen

✓ Tendon problems represent a major problem in sports
✓ 30% of all injuries in runners were related to the Achilles tendon
  Lysholm et al: AJSM '87
✓ Patellar tendinopathy (jumpers knee) most frequent knee injury
  » 14% incidence in volleyball players
  » 12% incidence in basketball players
  Zwerver et al: AJSM '11
✓ Tendon problems often become chronic – resistant to Rx
Eccentric Exercise & Tendinopathies

- Non-operative Rx with significant success
- Clinical studies illustrate 40-90% good outcomes after eccentric daily program of 5 to 12 weeks
  - Alfredson et al: AJSM ’98
  - Ohberg et al: BJSM ’04
  - Langberg et al: SJMSS ’07
  - Jonsson et al: BJSM ’09
  - Visnes et al: BJSM ’07
  - Kongsgaard et al: SJMSS ’09
- Best documented Non-Op Rx for Tendinopathy
  - Ackermann & Renstrom J Spots Health ’12

Stanish et al: CORR ’86

- 200 patients with tendinitis treated with eccentric exercise Sx over 18 mos
- Once daily for 6 weeks of eccentric exercise
- 44% complete pain relief
- 43% marked improvement
- 9% virtually no change
- 2% were worse


- 12 Danish elite soccer players with Achilles tendinosis & 6 healthy players
- 12 week heavy resistance eccentric(2xDay) program (3 sets of 15 reps at 20% BW)
  - Collagen synthesis/formation injured area
  - VAS pain level reduced from 44 to 13
  - All players returned to play

Jonsson & Alfredson: Br J Spts Med ’09

- Prospective randomized study athletes (mean age 25 yrs) with jumpers knee
- Compared eccentric to concentric exercise – decline single leg squat quadriceps training
- Performed 3 sets of 15, 7 days/wk for 12 wks
  - Eccentric group: 9/10 satisfied VAS score from 73 to 23 (p<0.005)
  - Concentric group: 9/9 not satisfied, VAS 74 to 67 (p<0.34)


- Randomized controlled single blind study
- Compared corticosteroid injection (CORT) to Heavy Slow Resistance eccentrics (HSR)
- HSR group elevated collagen turnover
- CORT group good short term results but poor long term results
- HSR group good short & long term results, subjective improvement, collagen synthesis
Eccentric Training with Stretching Programs

Dimitrios et al: Clin Rehabil ‘11
- Eccentric training with static stretching (N=22) produced superior results to eccentric alone (N=21) in patellar tendinopathy patients (p<0.0005)

Witvrouw et al: AJSM ‘01
- Prospective risk factors for patellar tendinitis
- 138 asymptomatic young athletes (mean age 18 yrs)
- 19 developed patellar tendinitis
- Risk factor: quadriceps & hamstring tightness (p<0.05)

Effects of Eccentric Exercise

- Tendon loading promotes collagen synthesis & collagen fiber cross linking – facilitation tendon remodeling
  - Magnusson et al: Nat Rev Rheumatol ‘10
- Eccentric produces more force by 150-300%
- Duration of exercise 3 months
  - Visnes et al: Br J Spots Med ’07
- Same amount of time for tendon to form new fibroblasts
  - Ackermann & Renstrom: JSH’12
- Exercise may stimulate new tendon cells – fibroblasts that adapt to load

Collagen Synthesis & Degradation after Exercise

- Collagen expression peaks at 24 hrs post-exercise
- Net loss around 24-36 hrs post-exercise
- Followed by net of collagen synthesis 36-72 hrs ??

Magnusson: 2010

Effects of Eccentric Exercise

- Exercise exert mechanical effects on cells of nerve fibers & their receptors
- Seems to accelerate sensory n. retraction
  - Bring et al: J Orthop Res ‘07 & ’09
- This may assist neuromodulation of pain
- Nerves alter the chemical milieu in response to load – either through release of antinociceptive substances (opioids) or by decreased production of nociceptive substances (substance P)
  - Ackermann et al: Front Biosci ’09

Eccentrics & Tendinopathies

Effectiveness of Eccentrics

- Jonsson et al: Br J Spots Med ’09
- Magnusson et al: Nat Rev Rheumatol ‘10
- Fahlstrom et al: Knee Surg Spts Traum Arth ’03
- Stanish et al: CORR ’86

Tendinopathies in Sports

How should we Rehab Tendons ??

Chronic (3-100 mos) Achilles overuse (n=15)

- Eccentric training with straight bent knee
- 12 weeks. 7 days. 3x15 rep
- Increasing load
- Pain was accepted during running
- Running activity was allowed

All 15 were back to preinjury levels with full running activity

Alfredson: AJSM ’98
**Tendinopathies in Sports**

**Introduction**

**Tendinitis vs Tendinosis**
- Inflammation
  - Acute Hemorrhage
  - Fiber Disruption
  - Neutrophils
- Mucoid Degeneration
- Sporadic inflammation
- Fiber Disorganization
- Angiofibroblastic Hyperplasia

---

**MRI**

**Normal**

**Tendinosis**

---

**Tendinosis Cycle**

- Tendon Injury
- Adequate Repair
- Inadequate Repair

---

**Patellar Tendinosis**

**Treatment**

- Heat
- Transverse massage
- Active warm-up
- Stretch (entire LE, esp quads)
- Pain stimulation*
- Strengthening program - eccentrics
- Stretch
- Laser
- HVS, compression, ice
- "level of acceptable pain" (5-6)

---

**Blazina et al: Orthop Clin North Am ’73**

- I: Pain only after participation
- II: Pain with participation, but doesn’t interfere with level
- III: Pain during / after participation, limits performance
- IV: Complete tendon rupture
Specific Noxious Stim Parameters:
- Frequency: 2500Hz
- Pulses: 50 pps
- Duty cycle: 10/10
- Duration: 10-12min
- Intensity: Noxious

Patellar Tendinosis
Eccentric Loading Program

II. Eccentrics (quadiceps)*
*use of pain stim
- Light - Moderate - Heavy Resistance
- Slow resistance movements
  ✓ Eccentric Leg Press
  ✓ Eccentric leg extensions
  ✓ Front step downs
  ✓ Single leg decline squat
  ✓ Lateral step downs
  ✓ Single wall slides

Correct PF Biomechanics
Witvrouw et al: AJSM ‘01
• Intrinsic risk factors for patellar tendinitis (prospective study)
• 138 young adults (18 yrs) athletics
• Studied for 2 years
• 19 developed tendinitis
• Prospectively assessed anthropometric variables leg alignment, flexibility, & strength
✓ Positive correlation: *Quadriceps tightness*

Wilk, Arrigo, Andrews: 2015
• 24 patients with confirmed patellar tendinopathy by MRI (22 males)
• Average age 22.8 yrs (17-29 yrs)
✓ 91.6 % (22/24) returned to pre-injury level of sports
• Subjective reports:
  » Minutes of play
  » Quality of play
  » Effectiveness (what % of 100% are you)

Rehab of Tendinopathies
Treatment

Tendinopathies in Sports
Conclusions
✓ Common lesion in sports (workplace)
   Difficult to treat – Challenging Lesion
✓ Various Rx strategies for tendinopathies
✓ Eccentric appears to stimulate healing response through collagen synthesis & remodeling – may require 12 weeks
✓ HSR (E/C) effective for LE tendinopathies
✓ Pain is common with this lesion
✓ Noxious pain stim may assist & allow people to exercise with minimal pain
Thank You!!