Tendinopathies in Sports

Introduction

- Tendinopathy:
  - Clinical syndrome – often not always implies overuse tendon injuries
  Ackermann & Renstrom: JSpts Health ’12
  - Characterized by pain, diffuse or localized swelling & impaired function
  - Pain is central factor in tendinopathies
    Konsgaard et al: SJMSS ’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 Reumatol ’10
  - Due to complex nature of tendinopathy is a sign. challenge to Rx by clinicians
    Konsgaard & Landberg: SJMSS ’11

Peritendinitis ➟ Tendinosis

Tendinopathies in Sports

Introduction

- 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 Reumatol ’10
  - Theoretical Overuse injury is a result of mismatch:
    Landberg: SJMSS ’07

Mechanical Loading ➟ Adaptation of Collagen

Tendinopathies of the Lower Extremity:
Basic Science & Clinical Practice

Kevin F Wilk, DPT, PT, FAPTA
Champion Sports Medicine
Birmingham, AL

© 2017 Champion Sports Medicine

Tendinopathies in Sports

Introduction

- 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
  Zwerver et al: AJSM ’11
  - 12% incidence in basketball players
- Tendon problems often become chronic – resistant to Rx

Tendinopathies in Sports

Introduction

- 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
  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 6 to 12 weeks

Alfredson et al: AJSM ’98
Ohberg et al: BJSM ’98
Langberg et al: SMMS ’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 Spts Health ’01

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 eccentric (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)

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**
- 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 antinoceptive substances (opoids) or by decreased production of noceptive substances (substance P)
  - Ackermann et al: Front Biosci ’09

Eccentrics & Tendinopathies

**Effectiveness of Eccentrics**

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

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%
  - Komi et al: SJRM ’74
  - Selinger: Eur J Appl Physiol ’80
- Duration of exercise 3 months
  - Visnes et al: Br J Spts 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

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**
**Introduction**

- Inflammation
- Acute Hemorrhage
- Fiber Disruption
- Neutrophils
- Mucoid Degeneration
- Sporadic inflammation
- Fiber Disorganization
- Angiofibroblastic Hyperplasia

---

**Tendinosis vs Tendinitis**

- **Tendinosis**
  - Over-repair: Excessive scar
  - Increased vulnerability to injury
  - Further decrease in collagen and matrix
  - Tenocyte Metaplasia
  - Apoptosis

- **Tendinitis**
  - Over-repair: Excessive scar
  - Increased vulnerability to injury
  - Further decrease in collagen and matrix
  - Tenocyte Metaplasia
  - Apoptosis

---

**Patellar Tendinosis**

- 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 (quadriceps)*

*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

Effect of decline squat

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

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!!