CURRENT CONCEPTS IN TENDINOPATHY MANAGEMENT: WHAT HAPPENED TO ECCENTRICS?

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CASE EXAMPLE

• 42 year old male with L Achilles pain
• Treated with soft tissue mobilization & eccentric exercise
• Complains of pain after activity and stiffness after rest
• Recovery course

WHAT IS TENDINOPATHY?

“...nonrupture injury in the tendon or paratendon that is exacerbated by mechanical loading”
Scott et al, 2015

PATHOPHYSIOLOGY MODELS

• Variable
• Do not account for changes over time
• Neglects role of central pain processing
• No direct relationship between structure, pain, and dysfunction
**INFLAMMATION**

- Classic inflammatory response
  - Rupture or laceration
- Response in pathological tendons
  - Inflammatory markers
- Cellular degradation and synthesis
- Serves as basis for R.I.C.E. treatments

Cook et al. 2015
COLLAGEN DYSREPAIR

- Initially thought of as “kinking” of collagen fibers
- Currently thought of as under-stimulation of tendon
- Served as basis for use of cross friction mobilization

Cook et al. 2015

PATHOPHYSIOLOGY MODELS
TENDON CELL RESPONSE

- Tenocytes maintain cellular environment
- Cell activation
- Proteoglycan expression
- Changes in collagen types
- Used to explain development of fibrocartilage

PATHOPHYSIOLOGY MODELS

- Healthy tendons are relatively avascular
- Neurovascular ingrowth
  - Formation of new nerves and blood vessels
- Conflicting evidence on neovessels
- Used for diagnosis purposes and use of medical procedures

Cook et al. 2015

Tol et al. 2012
CENTRAL SENSITIZATION

- "Altered somatosensory perceptions"
  - Peripherally and centrally
- Helpful in short-term, maladaptive in long-term
- Characterized by mechanical or thermal sensory gain
- Reduced pressure pain threshold

Pluimpa et al. 2015
Littlewood et al. 2013
Tompra et al. 2016

CONTINUUM MODEL

Stress shielded
Normal or excessive load + / - other factors
Optimized load
Strengthen
Optimal load
Adaptation
Reactive tendinopathy
Degenerative tendinopathy

Cook et al. 2015
CONTINUUM MODEL

- Classify tendon from “reactive” to “degenerative”
- Does not emphasize pathophysiology
- Guides intervention selection based on stage
- Explains changes over time

Cook et al. 2015
CHARACTERISTICS OF DEGENERATIVE TENDON

• Decreased mechanical responsiveness to loading
• Decreased inherent stiffness
• Increased cellular turnover

KEY CONCEPTS

STRETCH-SHORTEN CYCLE (SSC)

“an active stretch (eccentric contraction) of a muscle followed by an immediate shortening (concentric contraction) of that same muscle.”

Energy storage and release
STRETCH-SHORTEN CYCLE (SSC)

STRETCH-SHORTEN CYCLE (SSC)

STRETCH-SHORTEN CYCLE (SSC)

REACTIVITY: “24 HOUR RULE”

**Reactive pain:**
symptom aggravation following energy storage activities

**Irritable:**
provocation lasting greater than 24 hours

**Stable:**
settles within 24 hours

Malliaris et al. 2015
REACTIVITY: 24 HOUR RULE

Before

After

WHY 24 HOURS?

Breakdown

Synthesis

24 Hours 72 Hours

Magnusson 2010

WHY 24 HOURS?

Breakdown

Net collagen loss within 24-36 hours

Synthesis

24 Hours 72 Hours

Magnusson 2010
### ROLE OF COMPRESSION

<table>
<thead>
<tr>
<th>Type of Tendon Load</th>
<th>Biological Response</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression</td>
<td>Catabolic</td>
<td>↓ tensile strength</td>
</tr>
<tr>
<td>Tension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than normal</td>
<td>Catabolic</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>Catabolic=Anabolic</td>
<td></td>
</tr>
<tr>
<td>Slightly greater than normal</td>
<td>Net Anabolic</td>
<td></td>
</tr>
<tr>
<td>Much greater than normal</td>
<td>Net Catabolic</td>
<td></td>
</tr>
</tbody>
</table>

Grimaldi et al. 2015

### BALANCING OF FORCES

- Net collagen gain 36-72 hours
- 24 Hours
- 72 Hours

Magnusson 2010
FUNCTIONAL LIMITATIONS
UPPER EXTREMITY

• Common complaints
  • Reaching
  • Lifting
  • Carrying
  • Gripping
  • Typing

FUNCTIONAL LIMITATIONS
LOWER EXTREMITY
FUNCTIONAL LIMITATIONS
LOWER EXTREMITY

• Common complaints
  • Sitting
  • Stairs
  • Walking/running
  • First steps in the morning
  • Lying on side

EXAMINATION COMPONENTS

• History
• Palpation
• High load test – progression of testing
  • Rotator cuff testing
  • Extensor/flexor tendon testing
  • Single leg bridge
  • Single leg decline squat (see video 1)
  • Single leg heel raise

NOT ALL LOADING STRATEGIES/EXERCISE TYPES PRODUCE THE SAME RESULTS
TYPES OF LOADING

**Heavy Slow Resistance (HSR)**

**Eccentrics (ECC)**

- Bodyweight exercises promoting single limb eccentric loading

**Heavy Slow Resistance (HSR)**

- Slow, Fatiguing Resistance Through full ROM

**Eccentrics (ECC)**
TYPES OF LOADING

Isometrics (ISO)
Contractions in which joint angle and muscle length do not change

BE AN EXERCISE EXPERT

Different Loading Types

Prescription

Desired Effects

Progression of Exercise

EXERCISE PRESCRIPTION

<table>
<thead>
<tr>
<th>Loading Type</th>
<th>Prescription</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isometric</td>
<td>3-5 x 45-60 seconds</td>
<td>2-3x/day</td>
</tr>
<tr>
<td>Heavy Slow Resistance</td>
<td>3-4 sets 6-15 reps</td>
<td>Every other day</td>
</tr>
<tr>
<td>Eccentrics</td>
<td>3x15</td>
<td>2x/day</td>
</tr>
</tbody>
</table>
BE AN EXERCISE EXPERT

- Different Loading Types
- Prescription
- Desired Effects
- Progression of Exercise

COMPARING OUTCOMES

<table>
<thead>
<tr>
<th>Eccentrics</th>
<th>Heavy Slow Resistance (HSR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More time consuming</td>
<td>&gt; Compliance levels</td>
</tr>
<tr>
<td>Improved pain and function</td>
<td>&gt; Pt satisfaction at 12 weeks</td>
</tr>
<tr>
<td>No equipment</td>
<td>Gym equipment or weight</td>
</tr>
<tr>
<td>Clinician familiarity</td>
<td>&gt; Collagen turnover</td>
</tr>
<tr>
<td>Longer research history</td>
<td>↓ Swelling/vascularization</td>
</tr>
</tbody>
</table>

- Beyer et al. 2015
- Kongsgaard et al. 2009

ISOMETRICS

↓ pain & cortical inhibition
@ 40-70% MVIC

- Rio et al. 2015
- Naugle et al. 2012
BE AN EXERCISE EXPERT

- Different Loading Types
- Prescription
- Desired Effects
- Progression of Exercise

COMMON LOADING PROGRESSION

- Pain
- Strength
- Functional Strength
- Power
- Stretch-Shortening Cycle
- Sport Specific

ENDURANCE & COMPRESSION LOADS

ENERGY STORAGE & RELEASE

STRENGTH

Required Capacity

Cook 2015
TIPS FOR REHAB

• Non-compressive → compressive (A.K.A. mid-range)
• Ensure proper muscle activation
• Rest between every repetition!
  • Early rehab
• “Dimmer” switch → strobe light

MID-RANGE ISOMETRICS
MID-RANGE ISOMETRICS

HSR FOR PATELLAR, ACHILLES, & ROTATOR CUFF TENDONS
RETURN TO ACTIVITY DECISION MAKING

“Activity within reactivity”

MANY FACTORS INFLUENCE OUTCOMES

PERSONAL FACTORS

- Age
- Occupation
- Medication use
- Medical history
ADJUNCT TREATMENTS

- Injections (US-guided)
  - Cortisone, PRP, high volume, etc

- Percutaneous procedures
  - Tenex/Tenotomy/Tendon scraping

- Soft tissue/joint mobilizations

- Bottom line: These do not address tissue loading!
SUMMARY (H.E.L.P)

H-istory
Pain behavior, treatments, sensitization

E-ducation
Load management, cognitive-behavioral

L-oading progression
“Activity within Reactivity”

P-lyometric/Play

REFERENCES


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