Hamstring Muscle Strain Management: Any Role for Medical Interventions?

Dr Bruce Hamilton

The Role of the Sports Physician?

• Diagnostics
• Coordination
• Monitoring
• Return to Play

Interventions
Possible Medical Interventions?
No Substantial Clinical Evidence  |  Substantial Clinical Evidence

- Aspiration
- Magnesium
- Cortisone
- Anti-Spasmodics
- Trigger Point

- Anti-fibrotics
- NSAIDs
- Actovegin
- PRP
- Traumeel

?-?
No Intuitive Sense and/or No Basic Science Support

Intuitively Sensible or Basic Science Support

- Magnesium
- Aspiration
- Cortisone
- Anti-fibrotics
- Actovegin
- Anti-Spasmodics
- PRP
- NSAIDs
- Traumeel
- Trigger Point

0-48 hrs
Degeneration ➔ Aspiration

0-96 hrs
Inflammation ➔
- Traumeel
- Cortisone
- NSAIDs

7-28 d
Regeneration ➔ PRP

10-35 d
Fibrosis ➔ Anti-Fibrotics

Fu et al. XIV Int CSRT 2005
Shen et al. AJP 2005
1. Minimising Degeneration
   Optimising Position

Aspiration of a Haematoma

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- 
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2. Optimising Inflammation

Toumi & Best BJSM 37: 2003
Brickson et al. JAP 2003
Pizza et al. J Physiol 2005
Non-Steroidal Anti-inflammatories

“Theoretically will reduce pain, limit “inflammation” and allow earlier muscle recovery”

Drezner CJSM 2003
NSAIDs

• Mouse: Compared Paracetamol and COX II
  • No difference in histological appearance or function between the two groups
  Rhusen et al. AJSM 2004

• Rat Tib Ant: NSAID post injury
  • Stronger at 48 hours
  • Progressively got weaker compared to control
  • Delayed inflammation and muscle regeneration
  Almekinders & Gilbert AJSM 1986

NSAIDs

• COX II (NS-398) Specific Inhibitor
• Mouse laceration model
• 3-4 days:
  • Reduced neutrophils and macrophages
  • Reduced proliferation and differentiation of myogenic precursor cells
• 14 days:
  • Reduced regenerating muscle fibres, delayed maturation of muscle fibres
  • Increased fibrosis
• 28 days:
  • No significant differences in regeneration
  • Trend towards increased fibrosis
  • Increased TGF-β and myostatin
  • Dose and duration dependent
Shen et al. AJ Pathology 2005

NSAIDs Relative Contraindication following muscle injury
Intra-muscular Corticosteroid Injection

“…a few responded spectacularly, some showed partial improvement and others showed no significant improvement…”

Lloyd: Some Hazards of Athletic Exercise
Proceedings of the Royal Society of Medicine

“…deferring the onset and retarding the rate of muscle regeneration after a simple crushing injury, [but] does not change the course or eventual outcome…”

Sissons & Hadfield
JBJS 1953
AJSM 2000/2010
Intra-muscular Corticosteroid Injection for Hamstring Injuries

- 58 Professional NFL players
- Grade IIb Injury
  - Major (pain, reduced ROM, Weak [sic] to resistance)
  - Discrete, localized to finger tip, palpable defect
- 4 mg Dexamethasone & LA injected
  - Unguided (no previous imaging)
  - Compression / rest 48 hours
  - NSAIDs

Levine et al. AJSM 2000

Intra-muscular Corticosteroid Injection for Hamstring Injuries

- NO complications
- NO recurrences
- Average RTP 7.6 days
- 49/58 missed no games (presumably < 1 week)

Levine et al. AJSM 2000
Corticosteroids

- Rat gastrocnemius contusion
- Gluteal CS injection
- Histological assessment Days 2, 7, 14

- Day 2: Reduced inflammatory cells and oedema
- Day 7: Delayed inflammatory response with more PMN and macrophages, few fibroblasts and myotubules and residual necrotic tissue
- Day 14: Marked atrophy, disorganised muscle fibres and disrupted normal architecture

Remains Contentious
Routinely Contraindicated

Beiner et al. AJSM 1999

Traumeel
Traumeel

Botanical ingredients:

Arnica montana, radix (mountain arnica)
Calendula officinalis (marigold)
Hamamelis virginiana (witch hazel)
Millefolium (milfoil)
Belladonna (deadly nightshade)
Aconitum napellus (monkshood)
Chamomilla (chamomile)
Symphytum officinale (comfrey)
Bellis perennis (daisy)
Echinacea angustifolia (narrow-leafed cone flower)
Echinacea purpurea (purple cone flower)
Hypericum perforatum (St. John’s wort)

Mineral ingredients:

Hepar sulphuris calcareum (calcium sulfide)

“The exact mechanism of action of TRAUMEEL® Injection Solution is not fully understood”

“TRAUMEEL® Injection Solution does not inhibit the arachidonic acid pathway of prostaglandin synthesis”

“modulation of the release of oxygen radicals from activated neutrophils, and inhibition of the release of inflammatory mediators (possibly interleukin-1 from activated macrophages) and neuropeptides”

Traumeel®: Technique

No Evidence for Benefit

Function of Growth Factors

- **Stimulation:**
  - Satellite Cell Activation/Differentiation
    - HGF, bFGF, IGF-1, NGF, PDGF-BB
  - Satellite Cell Proliferation
    - HGF, bFGF, IGF-1, NGF, PDGF-BB
  - Fibrosis
    - TGF α/β

- **Inhibition:**
  - Satellite Cell differentiation / Proliferation
    - TGF α/β

Charge & Rudnicki Physiol Rev 2003
Clinical Utility of Individual GF in Muscle Strain Injury

- Mouse model of muscle *contusion / strain*
- GF (IGF-1, bFGF, NGF) injected day 1,3,5 post injury
  - Increased strength 15 days post injury
  - Increased number and size of regenerating myofibres

Kasemkijwattana et al.
Cell Transplantation, 1998

Clinical Utility of Individual GF in Muscle Strain Injury

- Mouse model of muscle *laceration*
- GF (IGF-1 or bFGF or NGF) injected day 1,3,5 post injury
- Analysed 7 / 28 days post injury
  - Increased regenerating (number, size) fibres (7 days)
  - Reduced fibrosis in treated muscles
  - Improved twitch strength (bFGF, IGF-1) 28 days

Menetrey et al.
JBJS (Br) 2000
Evidence from Human Trials


IGF-1, TGF-β, VEGF, PDGF, bFGF, HGF, IGF-1, TGF-β, VEGF, PDGF, bFGF, HGF 

Injury

We Don’t Know!
4. Anti-Fibrotic Agents

- Relaxin (IGF family)
- Decorin (Proteoglycan)
- Suramin (Anti-parasitic)
- Interferon Gamma (TGF-β Inhibitor)
- Losartin (Anti-Hypertensive)

Laboratory evidence of enhanced Healing, reduced scarring

Kazumasa et al AJSM 2001
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Laboratory evidence of enhanced Healing, reduced scarring

Kazumasa et al AJSM 2001
Conclusion

Medical management of muscle injury remains poorly understood, poorly researched, and probably poorly applied

A great opportunity

Thank You