Rehabilitation of Adductor Strains and the Core in Ice Hockey Players

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Disclosure
I have nothing to disclose

Lost Time
- Lost ice time means = $$$$$$$$$
- Top players
- Groin strains
- 25 player games/year
Presentation Goals

- Groin strain incidence
  - NHL/World
- Identify risk factors
  - Evidence
- Prevention
- Mechanism of injury
- Rehabilitation principles
- What’s new in bracing?
- Return To Play

Groin Strain Incidence

- Sweden: 10% of all injuries
  - Lorentzon et al. AJSM, 1988
- Finland: 43% of all muscle strains
  - Mola et al. AJSM, 1997
- United States:
  - 3.2 groin strains per 1,000 player-game exposures (Professional)
    - Tyler TF et al. AJSM 2001
  - 2.75 groin strains per 1,000 player-game exposures (College)
    - Schick and Meeuwisse AJSM 2003

NHL Epidemiology

- 7,050 NHL players 1991-97
- ANY TYPE OF GROIN PAIN
- 617 groin/abdominal injuries reported
  - > 90% Non-contact
    - Training camp > Regular season > Playoffs
- Mean lost time to groin strains (6.59 games and/or practices)

NHL Epidemiology

- 2010-2011 NHL Season
- Second most common injury
- 106 players lost 446 games to injury
- >50% adductor mm strains

Reference: AOSSM Instructional Course, 2011

Risk Factors?

Doha agreement meeting on terminology and definitions in groin pain in athletes


**Abstract**

Differences in terminology of groin pain in athletes with a chronic condition. The Doha agreement meeting on terminology and definitions of groin pain in athletes was convened to attempt to standardize the terminology and definitions used among different researchers.

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**Background**

The Doha agreement on terminology and definitions in groin pain in athletes was convened to facilitate the exchange of ideas. The meeting was attended by experts in the field, and the consensus statement was developed based on discussions.

**Recommendations**

The Doha agreement on terminology and definitions in groin pain in athletes was developed to standardize terminology and definitions used among different researchers. The recommendations are based on consensus statements from the meeting.

**Fig. 5.1** Differential diagnosis—groin pain in the athlete.
Ice Surface

- The importance of ice, Farber M, Sports Illustrated 2003
- Ice surface varies
  - Soft – Hard
  - Soft ice
  - Increased force for propulsion
- No Hard data?

Skate Blade Hollow Depth

- 517 reported hollow depth
- Ave. 0.375 inches
- Grouped 1 SD below
- Result
  - Not predictive of injury

Experience

- Rookies Vs. Veterans
  - #? Vs. #?
- Veterans SX
  - Increased risk
- Effect of age or Increased exposure in veterans?
Age

- Are older players adductors stiffer &/or weaker?
- Unknown

Off-Season Training

- >18 off-season skating session
- 3X Decreased risk

Previous Injury

  - 23.5% recurrent
  - 2X increased risk
Flexibility

- Tyler TF et al. AJSM 29(2), 2001
- Hip Abduction ROM
- Thomas test
- Not a Factor

Hip Rotation ROM (IR/ER) NOT Tested

Strength

  - Peak isometric adduction torque
  - Not a factor
  - Many teams
  - Many testers
  - Poor inter-tester reliability

Preseason Hip Adduction Strength (N)

- Uninjured players
- Players with groin strain

P=0.02

Tyler TF et al. AJSM 29(2), 2001
**Muscle Imbalance**

- Tyler TF et al. *AJSM 29(2), 2001*
- Best predictor of future groin strain
  - Hip Adduction to Abduction Strength Ratio, $P = 0.003$
- Relative risk
- ADD< 80% ABD
- 17X Increased risk

Tyler TF et al. The association of hip strength and flexibility with the incidence of adductor strains in professional ice hockey players. *AJSM 29(2), 2001*

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**PREVENTION**

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**Strategy For Injury Prevention**

1. Identify the incidence of a specific injury
2. Identify risk factors for that injury
3. Design interventions to address the risk factors
4. Test the effectiveness of the intervention at reducing the incidence of that specific injury
Intervention Program

- 1999/00 & 00/01 NYI seasons 58 players
- 33 of these were classified as “at risk”
  - 17 players on program year 1
  - 21 players on program year 2

Intervention Program

- Warm-up
  - Bike
  - Groin stretches
  - Sumo squats
  - Side lunges
  - Kneeling pelvic tilts

Intervention Program

- Strengthening
  - Ball squeezes
  - Concentric adduction
  - Adduction in standing on cable column
  - Cable column crossover pulls
  - Single leg sliding board skating slides
Intervention Program

- Sports specific training
  - On ice kneeling adductor pull together
  - Cable column eccentric adductor skating simulation
  - Slide board skating

Results

- Pre-Intervention
  - 3.2 strains per 1000 player-game exposures ($p<0.05$)
- Intervention Seasons
  - Reduced to 0.71 strains per 1000 player-game exposures
  - 78% reduction in groin strains


Despite the Best Prevention, Groin Strains Do Occur
Possible Mechanisms of Injury

- **Skating Biomechanics**
  - **Accelerators**
    - Hip abductors & extensors
    - Concentric
  - **Decelerators/stabilizers**
    - Hip flexors & adductors
    - Eccentric

Sim FH & Chau EY. Injury Potential in Modern Ice Hockey. AJSM, 1979

Possible Mechanisms of Injury

- Two common mechanisms
- Eccentric contraction of adductor muscles
  - 1- sudden external rotation and adduction of lower extremity while leg is widely abducted
  - 2- Sudden stop/deceleration


Adductor Strain

- Renstrom et al. Groin injuries in athletes. BJSM 14, 1980
- 62% of groin strains involve adductor longus injury
Differential Diagnosis

- Sports hernia
- Abdominal strain
- Hip joint etiology
  - Labral tear
  - FAI
- Osteitis pubis
- Stress fracture
- Nerve compression syndrome
  - Obturator nerve entrapment
  - lateral femoral cutaneous nerve

REHABILITATION

Treatment

- **Passive Therapy**
  - Massage
  - E. Stim
  - Stretching
  - Ultrasound
  - Cold laser

- **Active Therapy**
  - Adductor strengthening
  - Abdominal strengthening
  - Bilateral balance activity
  - Single leg balance
  - Skating movements
    - Slide board
The Study

- Holmich et al. Lancet 353, 1999
  - 68 patients (chronic isolated adductor strains)
  - 34 AT Vs. 34 PT
    - AT TIW 6 weeks
    - PT BIW 6 weeks
  - Outcome measurements
    - Pain on adductor contraction
    - Pain during, after same level of sport
    - Return to previous level of activity

Holmich et al. Results

<table>
<thead>
<tr>
<th>Treatment Outcome</th>
<th>Active Training</th>
<th>Passive Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Fair</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Poor</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

79% in AT group had no residual pain & return to sport
14% in PT group had no residual pain & return to sport

Our Philosophy

- Early contraction of the muscle
  - Isometric
  - Isotonic against gravity
  - Isotonic against resistance
  - Eccentric
  - Functional eccentrics
Repair of Muscle Strain: Basic Science

- **Central Zone**
  - Gap between fiber stumps
  - Hematoma fills gap
  - Connective tissue scar replaces hematoma
  - Scar holds stumps together
  - Regenerating fibers must penetrate scar

- **Mediating Factors**
  - Lateral adhesion of endomysium protects scar from rupture
  - Up to 10 days post injury scar is weak link (thereafter it’s the fiber stump)
  - Early mobilization reinforces lateral adhesion
  - Myoblast proliferation accelerated by cyclic strain
  - New myotendinous junction formed by 10 days

Kjaer et al 2003

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Physiological Evidence

- **Day 0 – Start PROM & Isometric contractions**
  - **avoid immobilization**
  - Facilitates myoblast regeneration (Vandenburgh 1982)
  - Maintains fiber alignment at the site of injury (Kjaer et al 2003)

- **Day 3 – Start Submaximal Isotonics**
  - Limit scar formation without reinjuring fibers
  - (Vandenburgh 1982)

- **Day 10 – Start Eccentrics**
  - Prevent atrophy during fiber regeneration
  - By Day 10-14 post injury, Scar is actually stronger than the fibers (Kaariainen et al 1998)

Early isometrics, Maintain available ROM, BUT DON’T STRETCH

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Rehabilitation Phase I (Acute)

- **RICE** first ~48 hours after injury
- Modalities
- Submaximal isometric adduction
- Hip PROM pain-free
- Nonweight-bearing hip PRE’s
- Bilateral balance board

Rehabilitation

Clinical Milestone
- Concentric adduction against gravity without pain.
- Timeframe
  - Depends on grade
  - ? 3 days to 2 weeks

Rehabilitation Phase II (Subacute)
- Dynamic warm-up
- Concentric adduction with weight
- Adduction in standing
- Sumo squats
- Seated adduction machine
- Standing with involved hip flex/ext on cable column to simulate skating
- Single limb stance
- Balance board squats with throwbacks
- Bicycling/Swimming
- General Flexibility Program

Rehabilitation

Clinical Milestone
- Involved lower extremity PROM equal to that of the uninvolved side
- Involved adductor strength at least 75% that of the ipsilateral abductors.
- Timeframe
  - Our objective criteria for return to light skating

**Rehabilitation**

**Phase III (Return to activity)**

- Phase II exercises with increase in load, intensity, speed and volume
- **ECCENTRIC TRAINING**
  - Slide board
  - Lunges (in all planes)
  - Roller board


**Clinical Milestone**

- Adduction strength at least 90-100% of the abduction strength
- Involved muscle strength equal to that of the contralateral side

**Timeframe**

- Grade 1: 2 weeks - 4 weeks
- Grade 2: 4 weeks - 6 weeks
- Grade 3: 6 weeks - 10 weeks


**Bracing**

- Wraps
- The Bodyguard
  - www.antibodywear.com

Adductor Strength Tests

- Squeeze test
- ADD MMT Break

1- Unable to identify weak side
2- Ratio incalculable
3- Not validated
Abductor Strength Tests

Future Directions
- Adductor H-Test

Keys to Success
- Prevention
  - Identify players @ risk
  - Demand intervention program
  - Encourage off-season skating
  - ACHIEVE MUSCLE BALANCE
- Rehabilitation
  - 1-2 days rest MAX
  - Early active therapy
  - Use objective measures to guide progression
  - Don’t return to play too early
  - COMPLETE REHABILITATION

Prevention
- Identify players at risk
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Thank You