Implementation Strategies for ACL Injury Prevention: Practical Applications

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What is in Injury Prevention Program/Preventive Training Program?

• Exercise-based program

• Multi-faceted program consists of:
  – Plyometric
  – Balance
  – Agility
  – Flexibility
  – Strengthening

(Steffen, 2008; Gilchrist, 2008; LaBella, 2011; Walden, 2012)
Dynamic Warm-up/Injury Prevention Program

Dynamic activity  Acceleration Action  Jog Recovery

P-1  ~4 meters  P-2

~8 meters
Need for High Movement Quality
Need for High Movement Quality
Need for High Movement Quality
How Can We Promote COMPLIANCE?

I WANT YOU TO DO AN INJURY PREVENTION PROGRAM
Adapted from Padua, 2014

- Routine
- Positive reinforcement
- Ready to perform
- Desire for reward
- Perform PTP

Initiation of training
Modify Risk Factors Early
Fundamental Movement Skills
Create Habits
**2015 Basketball Dynamic Warm-Up**

"EO BASKETBALL!"

**Key Points: Land softly, get low, bend your knees**

### Court Set-up

- **Progressive Run**
- **Exercise**
- **Bad position**
- **Good position**

### Exercise Details

#### Elephant to Flamingo
- **Description**
  - Right foot forward with heel on ground and knee straight
  - Squat down on left leg and lean forward
  - Swinging arms down right leg to pull toes up
  - Step up onto right leg, pull left foot to left buttock to stretch left quad. Repeat with opposite leg.

#### Open / Close the Gate
- **Description**
  - Stand on left foot, Raise right knee up
  - Rotate right knee and hip out
  - Two step shuffle diagonally.
  - Repeat on left side
  - Repeat by "closing" the gates bring knees inward.

#### AHHHHH Lunge
- **Description**
  - Lunge forward onto right foot
  - Keep your torso straight and drive your hips towards the ground
  - Rotate arms across chest to stretch back
  - Repeat with opposite leg

#### Side Lunge
- **Description**
  - Lunge sideways onto right leg
  - Sit back and stretch *inside of leg*
  - Repeat on opposite side

#### Kick Walks
- **Description**
  - Step forward and balance on one leg
  - Raise your other leg straight ahead while keeping your knee straight.

#### Elevator Jumps
- **Description**
  - Squat down, jump up for max height, repeat 9 times

### Cues

- **Cue**
  - Elephant: Sit back little sitting in a Flamingo Bend your leg!
  - Rotate y to get a stretch!

### Exercise Descriptions

#### T Shuffle
- **Description**
  - Sprint to half court
  - Side shuffle to sideline
  - Side shuffle back
  - Sprint to end baseline

#### Balance Hops
- **Description**
  - Hands on hips
  - Hop forward from left foot onto right foot
  - Land low – bend at knees, hips, ankles
  - Balance on stance leg for 5 seconds
  - Repeat on opposite leg.

### Arrow Sequence

#### Common Errors
- Hips too low
- Hips too high

#### Lateral Hops
- **Hands on hips**
- **Land low, land softly**
- **Balance for 5 counts**
- **Repeat on opposite leg**

### Leaps

#### Cuts
- **Get low! softy!**
  - Skip for maximal height
  - Land softly
  - Repeat and sprint to 20 yard line

- **Explode diagonally to the right 3 steps**
- **Land on outside foot (right), plant, and cut in opposite direction.**

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**Exercise Description Cues**

- **Hold your balance seconds**
Are they ready for change?

- Knowledge
- Perceptions
  - Risk
  - Benefits
- Self-efficacy
- Social norm
Identify barriers & solutions

**Implementation Barriers**

- **Time**
  - Total Duration
  - Time of Day
- **Personnel**
  - Support Personnel
  - Individuals to Train
- **Environment**
  - Equipment
  - Location
- **Organization**
  - Goals & Metrics
  - Current Behaviors
- **Session Duration & Frequency**

**Padua, 2014**
Goals & Metrics

• What matters to them?
  – Warm-up, performance, sport-specificity

• Educate
Number of games missed due to injury is predictive of the number of team wins during a season

NBA Seasons 2001 - 2011

Impact of Injury in Sports

Padua, 2014

Team
- Team ranking (r = .93)
- Games won (r = .88)
- Points scored (r = .89)
- Point differential (r = .82)
- Total points over season (r = .93)
Noncontact anterior cruciate ligament injuries in male professional football players

85%

WHAT ARE THE MAIN MECHANISMS?

WHAT ARE THE MAIN MECHANISMS?

Three distinct predominant mechanisms

CASE 1

CASE 2

CASE 3

Pressing followed by re-gaining balance

Re-gaining balance after kicking

Landing after heading

PRACTICAL IMPLICATIONS

ACL injury preventive interventions, similar to what has previously been shown for female athletes, should focus on:

- General proprioception
- Neuromuscular control of the core and lower extremities
- Jumping and landing techniques for heading skills
- Reorienting strategy in active and passive tacking-free situations
- Ball-movement during pressing, pressing, and tack-free
- Functional and moving techniques during change of direction and changing pressing actions, minimizing the pressing situation
Efficacy of the FIFA 11+ Injury Prevention Program in the Collegiate Male Soccer Player

Holly Silvers-Granelli,∗†‡§ MPT, Bert Mandelbaum,†§ MD, Ola Adeniji,† MS, Stephanie Insler,† BA, Mario Bizzini,‖ PT, PhD, Ryan Pohlig,¶ PhD, Astrid Junge,‖ PhD, Lynn Snyder-Mackler,†# PT, ATC, ScD, and Jiri Dvorak,‖ MD

Investigation performed at Santa Monica Sports Medicine Foundation, Santa Monica, California, USA, and the University of Delaware, Newark, Delaware, USA
Acute Performance Changes

- **Power** \((Yamaguchi, 2005)\)
- **Strength** \((Yamaguchi, 2007)\)
- **Sprint time** \((Goodwin, 2002; Fletcher, 2007; Faigenbaum, 2006)\)
- **Vertical jump** \((Faigenbaum, 2006; Thompsen, 2007)\)
- **Agility tasks** \((McMillan, 2006)\)
Performance Changes over Time

- **Vertical jump** *(Chappell, 2008; DiStefano, 2012; Kilding, 2008; Hewett, 1996; Noyes, 2005)*

- **Hop distance** *(Herrington, 2010; Barber-Westin, 2010)*

- **Sprint speed** *(Kilding, 2008; Barber-Westin, 2010)*
### Organizational Goals

#### APFT SCORES

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<th>PD</th>
<th>DIME</th>
<th>p</th>
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<tbody>
<tr>
<td>Push-ups</td>
<td>63.57 (SD=33.36)</td>
<td>65.34 (SD=16.07)</td>
<td>0.267</td>
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<tr>
<td>Sit-ups</td>
<td>72.72 (SD=46.28)</td>
<td>72.44 (SD=41.13)</td>
<td>0.916</td>
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<td>2-mile Run</td>
<td>13:48 (SD=1:42)</td>
<td>13:28 (SD=1:19)</td>
<td>&gt;0.001</td>
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<tr>
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<td>91.08 (SD=14.16)</td>
<td>92.80 (SD=13.27)</td>
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<tr>
<td>Sit-ups</td>
<td>85.89 (SD=15.58)</td>
<td>86.53 (SD=15.11)</td>
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<tr>
<td>2-mile Run</td>
<td>92.45 (13.97)</td>
<td>95.38 (SD=11.73)</td>
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<td>Total Score</td>
<td>269.43 (SD=33.79)</td>
<td>274.71 (SD=31.97)</td>
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<td>Grade</td>
<td>C+</td>
<td>B-</td>
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Organizational “ideas”:
Sport Specificity

• Majority of programs are generic
  – Tested in soccer or handball
  – Do not include true “sport-specific” activities

• Sport-specificity
  – Makes it relatable
  – Perceived effectiveness
  – Options for increasing difficulty
  – Not boring
  – Fun!
Current Behaviors “Relative Advantage”

Where?
When?
How?
- Individual?
- Team-based?
# Relative Advantage

<table>
<thead>
<tr>
<th>Current Activities</th>
<th>Revised Activities</th>
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<tbody>
<tr>
<td>Hip Gates</td>
<td>Hip Gates</td>
</tr>
<tr>
<td>Quad Pulls</td>
<td>Quad Pulls</td>
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<tr>
<td>Butt Kicks</td>
<td>Butt Kicks</td>
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<tr>
<td>Hamstring Sits</td>
<td>Hamstring Sits</td>
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<tr>
<td>Hamstring Kicks Front</td>
<td>Hamstring Kicks Front</td>
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<tr>
<td>Hamstring Kicks Across</td>
<td>Hamstring Kicks Across</td>
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<td>Walking Lunges</td>
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<tr>
<td>High Knees</td>
<td>High Knees</td>
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<tr>
<td>Side Lunges</td>
<td>Side Lunges</td>
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<td>Side Shuffle</td>
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<td>Carioca</td>
<td>Carioca</td>
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<tr>
<td>Power Skips</td>
<td>Power Skips</td>
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<tr>
<td>Forward Hops to Balance</td>
<td>Forward Hops to Balance</td>
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**Missing:**
- Core Exercises
- Additional Balance
- Plyometrics

**Add:**
- Plank Series
- Side Hop to Balance
- Squat Jumps
Identify barriers & solutions

- **Implementation Barriers**
  - Session Duration & Frequency
  - Time
  - Environment
  - Organization
  - Personnel

- **Goals & Metrics**
- **Current Behaviors**
- **Equipment**
- **Location**
- **Support Personnel**
- **Individuals to Train**

- **Total Duration**
- **Time of Day**
Barrier: Time

- More is better
- Minimum
- Organizational constraints
- Total dosage
  - 10 min/day
  - 3 days/week
  - 6 weeks
  - $10 \times 3 \times 6 = 180$ min
CT Coaches Survey

Minutes Willing to Perform an IPP

<table>
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<tr>
<th>IPP Duration</th>
<th>Number of Respondents</th>
<th>Yes (%)</th>
<th>No (%)</th>
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<tbody>
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<td>5</td>
<td>150</td>
<td>88%</td>
<td>12%</td>
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<tr>
<td>10</td>
<td>125</td>
<td>79%</td>
<td>21%</td>
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<td>15</td>
<td>70</td>
<td>50%</td>
<td>50%</td>
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<td>20</td>
<td>50</td>
<td>26%</td>
<td>74%</td>
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<tr>
<td>30</td>
<td>25</td>
<td>20%</td>
<td>80%</td>
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Martinez, 2014
Retention of ACL IPP

*P<0.05

Padua, 2012
Identify barriers & solutions

- Implementation
- Barriers
- Time
- Personnel
- Environment
- Organization
- Total Duration
- Session Duration & Frequency
- Support Personnel
- Individuals to Train
- Goals & Metrics
- Current Behaviors
- Equipment
- Location
- Time of Day
- Total Duration
Identify barriers & solutions

- **Implementation Barriers**
  - Organization
  - Environment
  - Support Personnel
  - Goals & Metrics
  - Current Behaviors
  - Equipment

- **Time**
  - Session Duration & Frequency
  - Total Duration
  - Time of Day

- **Support Personnel**
  - Individuals to Train

**Goals & Metrics**
- Current Behaviors
- Equipment
- Location
Who will implement?

• Athletic Trainer
• Coach
• Athletes
• Strength & Conditioning staff
• Parent
• Teacher
Steps for “Training”

Establish:
• Knowledge of effectiveness
• Alignment with goals of “trainer” & organization
• Knowledge of program
• Self-efficacy
• Feedback
• Maintenance
Pryor, 2015
1) Establish administrative support
2) Develop an interdisciplinary team
3) ID barriers & solutions
4) Develop a scalable PTP
5) Train the trainers & users
6) Fidelity control
7) Maintenance/exit

Key Points
- Identify implementation barriers & develop solutions prior to developing a PTP
- Establish high-level of self-efficacy, not just knowledge
- Regular, targeted feedback on implementation fidelity
- Goal-oriented exit strategy
- Maintenance support plan

Padua et al., 2014
Acknowledgements

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RESEARCH & EDUCATION FOUNDATION
Thank you!
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