A Unique Model Integrating Research Driven Injury Prevention Methods and Clinical Care for Athletes

Corey Dawkins, MS, ATC
Dennis Borg, MS, ATC
David Howell, PhD, ATC

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Worse than Status Quo

It has not stayed the same, it’s gotten worse

• High School
• College
• Professional Sports
• Recreational athletes
• Sedentary lifestyles
• Economic Cost

“You don't make progress by standing on the sidelines, whimpering and complaining. You make progress by implementing ideas.”

-Shirley Chisholm
Overview of TMC Mission

- 1974 – Sports Medicine Charter, refocused 20 years ago
- Clinical care
- Research
- Injury Prevention
- Scholarships for Underserved Athletes
- Community
- Education

ACL Surgery @ 8 y.o.

Tommy John Surgery – 14 y.o. Teammate, same surgery @ 13 y.o.
ATC Roles

- Clinical
  - Review health history questionnaires for risk factors
  - Record objective ROM & strength measurements
  - Analyze 2D, 3D, and force plate trials
  - Refer to Sports Medicine MD when needed

- Injury Prevention
  - Develop individualized evidence-based programs
  - Help school/community coaches and ATCs implement
  - Community lectures

- Research
  - Ensure data accuracy/precision
  - Develop original research
  - Assist/Collaborate with Sports Medicine MDs on their research (new ACL reconstruction technique outcomes, RTP protocols, Active Kids, Figure Skating, etc)
Offerings at TMC

• Injury Prevention Evaluation (IPE)
• Gait Retraining
• Concussion Preparation and Prevention
• ACL Injury Prevention Class
• Dance Injury Prevention Program
• 3-D Motion Analysis - Pitching and Golf Analyses
• Coaching and Community Clinics
• Active Kids Programs
• Evidence-Based Private Training
Injury Risk Profile and Prescription for Prevention
Injury Prevention Evaluation

• Pre-arrival questionnaire
• Data collection
• Sports Medicine physician evaluation
• Exercise prescription
• Exercise instruction
• Follow-up
Pre-Arrival Questionnaire

• **Sports/Activity History**
  – What sports currently played
  – When did athlete start competitive sports

• **Training History**
  – Hours/week
  – Single sport training year round

• **Injury History**

• **Lifestyle Habits**
  – Sleep
  – Walk/Bike to school
  – Soda consumption
Data Collection

- Universal and sport-specific measurements
- Can approach 300 individual measurements in 3.5 hours
  - Anthropometric
  - Flexibility
  - Strength & power
  - Balance
  - Core strength
  - Functional movement
  - Cardiovascular endurance
  - 2D with force plate gait assessment
Physician Evaluation

- Sports Medicine physician
- Reviews measurements and pre-evaluation questionnaire
- Performs evaluation
  - Based on injury history and measurements
- Discusses with ATC
  - Emphasis points for prescription
  - Recommend other TMC programs
Exercise Prescription

• Sports Injury Prevention Prescription (SIPR Rx) software
  – Custom designed by our lead software developer
  – Based on evidence-based research by clinicians in CHB Sports Medicine
  – Compares pre-evaluation answers and clinical measurements to common risk factors
• ATC evaluates and edits exercise prescription if necessary
• ATC reviews prescription with client, including link for individualized videos.
IPE Purpose

• Client
  – Multifaceted evaluation
  – Sports medicine physician evaluation
  – Individualized exercise prescription

• TMC
  – Goal to prevent injuries
  – Gather data
    • Research into current lifestyle patterns, sports and training methods, and injury prevention
    • Evidence for interventions at the community level
    • Validate our injury prevention model to insurance companies
Thank You!!!
Injury Prevention Programs

Dennis Borg, MS, ATC, CSCS
Injury Prevention Specialist
Prevention Programs

- 3D Golf and Pitching Analysis
- Gait Retraining
- ACL Prevention & Return to Play
- Concussion Prevention
3D Analysis

- Joint ROMs
- Speed and Torques
- Kinematic Sequencing
Gait Analysis/Retraining
ACL Programs

- **Modifiable Risk Factors**
  - Decreased knee flexion
  - Core strength/ neuromuscular facilitation
  - Hamstring to quad strength ratio
  - Landing mechanics
  - Body composition
  - Ankle mobility?
Concussion Programs

- Prevention
  - Agility/Awareness
  - Neck Strength
  - Core Strength
  - Balance
The Micheli Center: Investigating Injury Risk Factors in Youth Athletes

David Howell, PhD, ATC

The Micheli Center for Sports Injury Prevention Division of Sports Medicine, Boston Children’s Hospital
Conflict of Interest

No disclosures or conflicts of interest to report related to the topic of this presentation
Current Projects

1) To establish a normative database for youth athletes on IPE measurements

2) To identify factors that affect postural control

3) To examine the effect of neck strength on risk of concussion

4) To investigate how year-round sport participation affects risk of injury
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>16.3 (9.2)</td>
</tr>
<tr>
<td>Age range</td>
<td>6 – 85</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164.1 (14.5)</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>59.0 (19.1)</td>
</tr>
<tr>
<td>BMI (kg/m^2)</td>
<td>21.5 (5.0)</td>
</tr>
<tr>
<td>Females (n, %)</td>
<td>338 (59%)</td>
</tr>
</tbody>
</table>
Postural Control

Balance and postural control impairments have been documented following sport-related injuries


Identification of postural control deficits currently reliant on an observer-rated score

Can we improve postural control assessments?

What is normal performance among youth athletes?
Normative Values

**Purpose:** to determine the expected performance range on a video-force plate postural control rating system in youth athletes.

Perform the 3 mBESS stances while rated by an objective rating system

# Postural Control Values (Double-Leg)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Above Average</th>
<th>Broadly Normal</th>
<th>Below Average</th>
<th>Poor</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Sample</strong></td>
<td>398</td>
<td>85.0</td>
<td>11.2</td>
<td>≥ 94</td>
<td>83-93</td>
<td>74-82</td>
<td>51-73</td>
<td>≤ 50</td>
</tr>
<tr>
<td><strong>Kids 8-12</strong></td>
<td>112</td>
<td>85.1</td>
<td>12.5</td>
<td>≥ 95</td>
<td>83-94</td>
<td>74-82</td>
<td>42-73</td>
<td>≤ 41</td>
</tr>
<tr>
<td><strong>Kids 13-15</strong></td>
<td>189</td>
<td>84.4</td>
<td>12.0</td>
<td>≥ 94</td>
<td>82-93</td>
<td>73-81</td>
<td>47-72</td>
<td>≤ 46</td>
</tr>
<tr>
<td><strong>Kids 16-18</strong></td>
<td>97</td>
<td>86.1</td>
<td>6.9</td>
<td>≥ 94</td>
<td>83-93</td>
<td>75-82</td>
<td>69-74</td>
<td>≤ 68</td>
</tr>
<tr>
<td><strong>Boys 8-12</strong></td>
<td>47</td>
<td>83.6</td>
<td>11.8</td>
<td>≥ 94</td>
<td>80-93</td>
<td>73-79</td>
<td>39-72</td>
<td>≤ 38</td>
</tr>
<tr>
<td><strong>Boys 13-15</strong></td>
<td>70</td>
<td>80.3</td>
<td>15.4</td>
<td>≥ 92</td>
<td>75-91</td>
<td>63-74</td>
<td>17-62</td>
<td>≤ 16</td>
</tr>
<tr>
<td><strong>Boys 16-18</strong></td>
<td>37</td>
<td>86.1</td>
<td>5.6</td>
<td>≥ 93</td>
<td>84-92</td>
<td>77-83</td>
<td>73-76</td>
<td>≤ 72</td>
</tr>
<tr>
<td><strong>Girls 8-12</strong></td>
<td>65</td>
<td>86.2</td>
<td>13.0</td>
<td>≥ 95</td>
<td>85-94</td>
<td>77-84</td>
<td>21-76</td>
<td>≤ 20</td>
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<td><strong>Girls 13-15</strong></td>
<td>119</td>
<td>86.9</td>
<td>8.5</td>
<td>≥ 94</td>
<td>84-93</td>
<td>78-83</td>
<td>52-77</td>
<td>≤ 51</td>
</tr>
<tr>
<td><strong>Girls 16-18</strong></td>
<td>60</td>
<td>86.1</td>
<td>7.7</td>
<td>≥ 94</td>
<td>83-93</td>
<td>73-82</td>
<td>67-72</td>
<td>≤ 66</td>
</tr>
</tbody>
</table>

Effect of Sex on Postural Control

Overall Postural Control Rating

- Double-leg stance
- Single-leg stance
- Tandem stance

Howell et al., *In Review*, 2016, n = 409
Effect of Sex on Postural Control

Howell et al., *In Review*, 2016, n = 409

- Double-leg stance
- Single-leg stance
- Tandem stance

Clinician Rated Errors

- Female
- Male
Implications

An objective postural control rating system provides a wider range of scores during the mBESS

Potentially eliminating ceiling/basement effects

Healthy female youth athletes may possess greater postural control than males, difficult to detect via observation
Head Impact Biomechanics
Neck Strength

For contact sport athletes:

Greater neck strength may be associated with reduced odds of sustaining a concussion

For every one pound increase in neck strength, odds of concussion decreased by 5 %

Collins et al., 2014, J. Prim. Prev
Mean (SD) normalized sagittal plane rotation strength for those who sustained a concussion (n = 7) and those who did not (n = 84)

Howell et al., In Prep, 2016
Cervical Rotation Strength

Mean (SD) normalized transverse plane cervical strength for those who sustained a concussion (n = 7) and those who did not (n = 84)

Howell et al., In Prep, 2016

- Sustained a concussion
- Did not sustain a concussion

Mean (SD) normalized transverse plane cervical strength for those who sustained a concussion (n = 7) and those who did not (n = 84)
Implications

Neck strengthening alone may not be sufficient to change how the head moves in response to an impact.

Neck strength, particularly in the transverse plane, may be a key factor in concussion occurrence.

A combination of strength and proper neuromuscular response training may reduce the risk of sport-related concussion.
Sport Specialization

Does year-round participation in a sport increase the likelihood of sustaining an injury?

Is there a sport you train year-round?

Males - Yes: 62 (26.8%)
Female - Yes: 65 (20.4%)
Injury History

1. Ankle sprain
2. Shin splints
3. Plantar fasciitis
4. ACL tear
5. IT band syndrome
6. Shoulder dislocation
7. Achilles tendonitis
8. Salter-Harris fracture
IT band syndrome : # of Sports

Single sport (9%) vs. 2 sports (5%) : p = 0.16

Single sport (9%) vs. 3 sports (2%) : p = 0.01

Implication: The proportion of ITB syndrome among those who compete in 1 year-round sport was higher than those who compete in multiple sports
Conclusions

1. Postural control abilities appear to differ among age groups and sex
2. Healthy female youth athletes demonstrate more postural stability than males
3. Increasing rotational neck strength may provide a method to decrease the risk of concussion
4. Multi-sport athletes have a lower proportion of IT band syndrome than single-sport athletes
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THANK YOU

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