Training Techniques for the Skeletally Immature Athlete

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Summary

- What does training “look-like” in the skeletally immature athlete?
- Why do skeletally immature (young) athletes need oversight by medical professionals?
- Prevention and training strategies for common injuries

What does training entail for the skeletally immature? Why do we need it?

- This is a resilient group of athletes that historically had few injuries other than direct trauma during game-play
  - Fractures, soft tissue injuries, sprains
- As we have earlier single-sport focus this group has become more vulnerable to overuse injuries at the physis and the apophysis

Prevention of common injuries

- Little league elbow and shoulder
- ACL tears and tibial eminence fracture
- Ankle Sprain and Salter-Harris I distal fibula fracture

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Little League Shoulder

• Overuse injury with pain at the shoulder
• Caused from overload on the proximal humeral growth plate (physis)

Little League Elbow

• Similar mechanism
• Valgus overload on the distal humerus causes irritation and widening of the medial epicondyle growth area.

Prevention?

• Provide proper instruction on throwing mechanics
• Discourage the teaching of curve balls until high school (puberty)
• Ban the radar gun in youth sports
• Mandate a 3 month “rest-period” each year for throwing athletes
• Pitch Counts and rest based on age and skeletal maturity
  – www.STOPsportsinjuries.org

San Diego Pitching Project

• Andy Pennock, MD and the group at Rady Children’s Hospital
  – Pre and Post season MRI and U/S of Little League players
  – 42% with pathologic changes in the elbow at the end of the season
  – Risk factors: year-round play and use of a private pitching coach

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San Diego Pitching Project

- Recommendations
  - Follow pitch counts based on age and skeletal maturity
  - All patients aged <13 should take a minimum of 3 months off per year from throwing activities
  - Implementation of rehab programs
    - Sleep stretch, and “Thrower’s Ten” programs

<table>
<thead>
<tr>
<th>Age</th>
<th>Daily Max (Pitches in Game)</th>
<th>Required Rest (Pitches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 Days</td>
<td>1 Day</td>
</tr>
<tr>
<td>7-8</td>
<td>50</td>
<td>1-20</td>
</tr>
<tr>
<td>9-10</td>
<td>75</td>
<td>1-20</td>
</tr>
<tr>
<td>11-12</td>
<td>85</td>
<td>1-20</td>
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<tr>
<td>13-14</td>
<td>95</td>
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<td>15-16</td>
<td>95</td>
<td>1-20</td>
</tr>
<tr>
<td>17-18</td>
<td>105</td>
<td>1-30</td>
</tr>
<tr>
<td>19-22</td>
<td>120</td>
<td>1-30</td>
</tr>
</tbody>
</table>

ACL Tears and Tibial eminence fractures

- Functionally similar injuries
- The ligament is stronger than the bone in young athletes
  - Leading to tibial eminence fracture

Prevention Programs

- MANY different prevention programs in place
  - PEP (Prevent Injury Enhance Performance)
  - SportsMetrics
  - Others
- What do they all include
  - Strength and Core training
  - Stability, Balance, Proprioception
  - Plyometrics
  - Technique feedback
- Do they work? YES!

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• PEP program
• Should be completed 3x/week during offseason/preseason training
  • www.la84.org
  • www.aclprevent.com

More important in females?
• YES!
• Why?
  – Valgus moment at the knee
  – More pivot and tibial translation
  – More ACL tears

Lateral Ankle Sprains and SH1 Distal Fibula Fractures
• Similar in the same right as ACL and tibial eminence fractures
• Main point is that “ankle sprains” in skeletally immature athletes are often growth plate fractures

Prevention
• Balance and proprioception programs

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The Effect of a Balance Training Program on the Risk of Ankle Sprains in High School Athletes

Timothy A. McGuire, PhD, and James S. Reene, MD
From the University of Wisconsin Hospital and Clinics, Sports Medicine Center, Madison, Wisconsin

Results: The risk of ankle sprains was significantly lower for subjects in the intervention group (0.1%: 1/0 of 101 episodes) vs. 9.9% (8/8 of 81 episodes), P = .04). Athletes with a history of an ankle sprain had a 2.4-fold increased risk of sustaining a sprain (risk ratio, 2.4-16), whereas athletes who performed the intervention program decreased their risk of a sprain by one-half (risk ratio, 0.50). The ankle sprain rate for athletes without previous sprains was 4.3% in the intervention group and 7.7% in the control group, but this difference was not significant (P = .55).

Conclusion: A balance training program significantly reduces the risk of ankle sprains in high school soccer and basketball players.

Table 2
The Balance Training Program

<table>
<thead>
<tr>
<th>Phase</th>
<th>Surface</th>
<th>Stage</th>
<th>Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Floor</td>
<td>Open</td>
<td>Single-leg stance</td>
</tr>
<tr>
<td>II</td>
<td>Floor</td>
<td>Closed</td>
<td>Single-leg stance while swinging the raised leg</td>
</tr>
<tr>
<td>III</td>
<td>Board</td>
<td>Open</td>
<td>Single-leg stance</td>
</tr>
<tr>
<td>IV</td>
<td>Board</td>
<td>Closed</td>
<td>Single-leg stance while rotating the board</td>
</tr>
<tr>
<td>V</td>
<td>Board</td>
<td>Open</td>
<td>Single-leg stance</td>
</tr>
<tr>
<td>V+</td>
<td>Board</td>
<td>Closed</td>
<td>Single-leg stance while rotating the board</td>
</tr>
</tbody>
</table>

*Phases I through IV were performed 5 days per week, Phase V was performed 3 days per week for the rest of the season. Each exercise was performed for a duration of 30 seconds per leg, and legs were alternated during a rest period of 20 seconds between repetitions.

Results

- Intervention program reduced the risk ratio of ankle sprain by 50%
• Eventually will do all of these exercises with the eyes closed – literally

• Ankle sprains:
  – Non-operative care
  – RICE
    • Rest
    • Ice
    • Compression
    • Elevation
  – Immobilization
    • Lace-up ankle brace
    • Stirrup brace
    • Fracture-boot
    – Possibly more recurrence than lace-up brace
    • Cast
  – Physical therapy – early
  – Operative mgmt: rarely indicated

The final bit of controversy...single sport specialization

• I don’t all have the answers
• BUT, here are some opinions

Sports Specialization in Young Athletes: Evidence-Based Recommendations

• Sports Health 2013

• Some degree of late (after adolescence) specialization is necessary for most athletes to reach “elite-level” skill development

• Early specialization (before puberty) leads to higher rates of injury, psychological stress, and early cessation from sport

• Sport specialization should be delayed until late adolescence to optimize success while minimizing injury, stress, and burnout

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• Advocates for early diversification in sports with late onset specialization
• Does specialization lead to greater “success”?  
  – Div I NCAA athletes more likely to have played multiple sports high school sports than not
  – 87% of athletes at 2015 NFL combine competed in multiple high school sports
    • Crossover skills noted highly for track/field, wrestling, and other sports
  – Overall, athletes who engaged in early specialization had shorter athletic careers

Just to confuse us all
• Systematic Review in Physician and Sportsmedicine. Sept 2016
• Only 3 articles met criteria for review
• Conclusions: The primary evidence that currently exists with regard to early sport specialization is scarce, retrospective, and shows only modest associations between early sports specialization and overuse injury. Further prospective research is needed to more definitively determine if early sports specialization in children is associated with increased injury risk.

My opinion
• Sports are FUN!
• Play lots
• Specialize when you have the chance to play for a free education, to support your family, or to represent your country

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