The Effect of a 6-Week Weighted Ball Throwing Program on Pitching Velocity, Arm Stress, and Injury Rates

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SABERMETRICS, SCOUTING AND THE SCIENCE OF BASEBALL

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Baseball Pitching Injuries Rising at an Alarming Rate
Emphasis on Velocity
Velocity and Elbow Stress

- Correlation between velocity and elbow stress has been shown
- High School
  - Hurd: Sports Health ‘12
- Professional
  - Bushnell: AJSM ‘10
Training Focused on Velocity Development
Max Velocity Program
Weighted Ball Programs
Do Weighted Balls Work?
Well, I guess that answers that question...
Past Studies

• Several studies have documented a significant increase in velocity
  – Reinold: APTA ‘18
  – DeRenne: SCJ ‘09

• Balls ranging from 4 – 17 oz
  – Most common 4-6oz (20%)

• Both under and overload effective
Enhance Velocity

- 6 weeks of dumbbells = 1.7% increase
  - Escamilla: JSCR ’12
- 4 weeks of tubing = 4% increase
  - Escamilla: JSCR ‘10
- 6 weeks of plyometric drills = 2% increase
  - Escamilla: JSCR ’12
- 7 week core stability and power program = 6% increase
  - Palmer: JAT ’12
- 6 week med ball program = 14%
  - Raeder: JSCR ’15
- 18 week total body strength = 2.6%
  - Ramos Veliz: JSCR ’14
- 6 week core stability program = 4.9%
  - Saeterbakken: JSCR ’11
Problems

• WB appear effective at enhancing velo
• Do not know
  – Mechanism of velocity increase
  – Kinematic changes
  – Kinetic changes
  – Safety – short and long term
  – Dosage
    • Frequency
    • Loads 2 oz – 5 lbs
    • Duration
Past Studies

• Fleisig et al: ‘16
  – Biomechanical analysis
  – 4 – 7 oz balls
  – Underload had significant increase in peak stress
  – Overload had decrease in peak stress
Study
Methods

- 44 male youth baseball pitchers 13-18 yo
  - WB group, control group

- Exclusions:
  - Current injury to the throwing arm
  - Past surgery to the throwing arm
Methods

• Range of Motion
  – Shoulder flexion, ER/IR @ 90, h.add
  – Elbow flexion, extension
  – Forearm pronation, supination
  – Wrist flexion, extension

• Strength
  – Shoulder ER/IR @ 90, abduction, full can
• Warm-up
  – Theraband sequence
  – 10 throws at 45’, 60’, 90’
Methods

• 10 FB off mound
  – Velocity, Varus torque, Maximum shoulder IR angular velocity
Training Program

- Weighted ball throwing program
  - 6 weeks
  - 3x per week
  - Weights of 2, 4, 6, 16, and 32 oz

- Control group
  - Only throw with standard 5 oz balls
Gradual Ramp Up in Program

Kneeling → Rocker → Run and Gun Volume
<table>
<thead>
<tr>
<th>Week</th>
<th>Knee</th>
<th>Rocker</th>
<th>Run &amp; Gun</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>75% x 3 each</td>
<td></td>
<td></td>
<td>15 throws</td>
</tr>
<tr>
<td>Week 2</td>
<td>90% x 3 each</td>
<td>75% x 3 each</td>
<td></td>
<td>30 throws</td>
</tr>
<tr>
<td>Week 3</td>
<td>100% x 2 each</td>
<td>90% x 2 each</td>
<td>75% x 2 each</td>
<td>30 throws</td>
</tr>
<tr>
<td>Week 4</td>
<td>100% x 2 each</td>
<td>100% x 2 each</td>
<td>90% x 3 each</td>
<td>35 throws</td>
</tr>
<tr>
<td>Week 5</td>
<td>100% x 2 each</td>
<td>100% x 2 each</td>
<td>100% x 3 each</td>
<td>35 throws</td>
</tr>
<tr>
<td>Week 6</td>
<td>100% x 2 each</td>
<td>100% x 2 each</td>
<td>100% x 3 each</td>
<td>35 throws</td>
</tr>
</tbody>
</table>
Results

• 39/44 completed the study
  – 3 from unrelated injuries
  – 2 from elbow injury during study
  – All from WB group

• 15.3 years old, 176.8 cm, 68.3 kg
• Mean velocity 68.6 mph
• No difference between groups
Results

• ICC
  – Velocity = 0.99 (ASMI = 0.96)
  – Valgus stress = 0.99 (ASMI = 0.99)
  – Angular velocity = 0.95 (ASMI = 0.93)

• Equally as reliable as full motion analysis
Results

• Velocity
  – WB group 2.3 mph increase (p = 0.001)
    • 12/15 – 80% - improved velocity (12% down)
    • Highest = 7.85 mph
  – 3.4% increase in velo
  – No difference in control group
    • 12/18 – 67% - improved velocity (14% down)

• No significant difference in valgus stress or angular velocity in either group
Results

• Range of Motion
  – WB group dominant ER and TRM increase of 5 degrees (p = 0.05, p = 0.01)
    • Two injuries = + 10 deg
  – No difference in ND arm or control group
Results

• Strength
  – Significant increase in ER strength in control group
    • +2.73 – 13% increase
Results

• Injuries
  – WB group 4 injuries (24%)
    • UCL sprain
    • Tommy John Surgery
    • Olecranon stress fracture x 2
  – No injuries in control group
What Have We Learned?
WB Programs Do Not Increase Arm Strength or Arm Speed
In Fact, May Inhibit Strength Gains
WB Programs are Effective at Increasing Velocity
But at What Cost?
Significant Increase in ER and TR ROM in Only 6 Weeks
Biomechanical Studies Have Shown ER Correlates to Velocity

Increases Shoulder and Elbow Forces:
Werner, AJSM ‘01; Werner, AJSM ‘08; Aguinaldo, AJSM ’09; Keller, Ortho ‘15
The Injuries We are Seeing are Alarming
2 Injured Players Gained 10 Degrees ER
Are We Pushing Past our Physiological Limits?
Are We Not Really Taking a Break from Throwing?
More Likely to Get Injured for Those Pitching > 8 Months Per Year

Olsen: AJSM ‘06
Overuse Not Just Quantity
Overuse is Equation of Quantity and Intensity
We Still Don’t Know The Appropriate Dose
Not Everyone Appropriate
We Must Individualize
Weighted Ball Training Can Not be the Foundation of a Velocity Program
Future Studies

Postseason Follow Up
Acute Changes
Different Components
Thank You!
Thank You!

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