The Effect of Humeral Retrotorsion on Pitch Velocity in Youth Baseball Players

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BACKGROUND

• Pitch velocity is a critical measure of performance in baseball
• Research has identified that players with faster pitching velocity are also at a higher risk of injury
• Although many factors may account for velocity, recently it has been suggested that an increased amount of humeral retrotorsion (HRT) may contribute to faster pitching velocities by virtue of increasing total arm rotational acceleration (Figures 1)

The relationship between HRT and pitching velocity has not been directly studied within the youth population

PURPOSE

• The purpose of this study is to examine the effects of HRT on pitching velocity in a group of youth baseball players

METHODS

• 76 healthy male baseball players aged 8-14 years-old (mean age: 11.4 years, range: 8.1-14.3 years)

MEASUREMENT PROCEDURES

Humeral Retrotorsion

Figure 1: Illustration of the proposed relationship between increased HRT and increased pitching velocity. A) Drawing depicting how an increase in HRT will shift the arc of shoulder motion towards an external rotation (ER) bias. B) The gain in shoulder ER created by the increase in HRT will allow for a greater degree of angular acceleration prior to ball release, resulting in increased propulsive forces to be transmitted during pitching.

Dependent Variable

Maximum pitching velocity captured by Stalker Sport 20® radar gun

Independent Variables

• Age
• Dominant shoulder ER range of motion
• Height
• Dominant arm IR strength
• Weight
• Dominant arm HRT

MEASUREMENT PROCEDURES

• Descriptive summary statistics calculated for all variables
• Univariate analyses using Pearson correlation coefficients examined the relationship of each variable to pitching velocity
• Significant variables retained and entered into multivariable regression analysis

REGRESSION ANALYSIS

• Overall model was significant (R² = 0.817 F(5,70) = 62.59, p<0.001) and account for 81.7% of the variance in pitch velocity
• Regression coefficient analysis: 3 variables contributed to the model

<table>
<thead>
<tr>
<th>Variable</th>
<th>B (SE)</th>
<th>P Value</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>1.7 (0.86-2.56)</td>
<td>&lt;0.001</td>
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<tr>
<td>Height (cm)</td>
<td>0.23 (0.10-0.35)</td>
<td>0.001</td>
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<tr>
<td>Weight (kg)</td>
<td>-0.43 (-0.16-0.07)</td>
<td>0.453</td>
</tr>
<tr>
<td>HRT (°)</td>
<td>0.005 (-0.07-0.08)</td>
<td>0.884</td>
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<tr>
<td>IR strength (kg)</td>
<td>0.62 (0.39-0.86)</td>
<td>&lt;0.001</td>
</tr>
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CONCLUSIONS / RELEVANCE

• In youth baseball players pitching velocity is strongly influenced by age, height and IR strength
• Although our results show HRT offered no net effect on pitching velocity, sub-analysis indicates the influence of HRT on pitching velocity varies with age, offering some advantage to the youngest players only
• Future studies should seek to examine this relationship in both skeletally immature and mature players, where HRT is no longer a variable trait

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Statistical Analysis

Bicipital groove identified with ultrasound and aligned with horizontal. Forearm inclination relative torsional difference between proximal and distal humerus. Measure is relative to horizontal so larger value is indicative of increased HRT

Gives relative torsional difference between proximal and distal humerus. Measure is relative to horizontal so larger value is indicative of increased HRT

The relationship between HRT and pitching velocity changes as a child ages. HRT is no longer a variable trait with age, offering some advantage to the youngest players only

Trend lines indicate a varying relationship of HRT on pitching velocity based upon age. Increased HRT may provide some increase in velocity in the younger years, however as the child ages, continued increase in HRT may actually decrease pitch velocity.