THROWING FROM THE GROUND - UP

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ORTHOPAEDIC SURGEON
GOALS

• Understand Kinetic Chain
• Kinematics of Throwing
• Muscle Control
• Proximal to Distal Kinetic Energy Flow
• Pick out Breakdown in Throwing Cycle
• How breakdowns cause injury
• What to Rehab
SEVEN SEGMENTS OF KINETIC CHAIN

• Lower Extremities
• Pelvis/Hips
• Spine
• Shoulder Girdle
• Upper Arm
• Forearm
• Hand
WIND-UP
WIND-UP

Stance Leg
- Eccentric Quad Firing
- Flexors
- Isometric Hip Abductor
- Isometric & Eccentric Hip Extensor

Lead Leg
- Concentric Contraction Hip

Trunk
- Slight Clockwise Rotation
<table>
<thead>
<tr>
<th>Stance Leg</th>
<th>Lead Leg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentric Hip Abduction</td>
<td>Eccentric Hip Flexor</td>
</tr>
<tr>
<td>Quadriceps &amp; Gluteus Maximus</td>
<td>Hip External Rotation</td>
</tr>
<tr>
<td>Hip Internal Rotation &amp; Extension</td>
<td>Knee bend 45° to 55°</td>
</tr>
<tr>
<td>Hip Flexor lowers center of gravity</td>
<td>Trunk Slight Tilt</td>
</tr>
<tr>
<td></td>
<td>Foot 5° to 20° Closed</td>
</tr>
<tr>
<td></td>
<td>Length of Stride 80% of Height</td>
</tr>
</tbody>
</table>
# STRIDE

## Shoulder Upper Extremity

<table>
<thead>
<tr>
<th>Component</th>
<th>Movement</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>80° to 100° Abduction</td>
<td>Deltoid &amp; Supraspinatus</td>
</tr>
<tr>
<td>Throwing Arm</td>
<td>22° Horizontal Abduction</td>
<td>Posterior Deltoid, Posterior Rotator Cuff, Latissimus</td>
</tr>
<tr>
<td>Scapula</td>
<td>Tilt Upward</td>
<td>Upper Trapezius &amp; Serratus</td>
</tr>
<tr>
<td>Elbow</td>
<td>Slight Flexion 25° to 35°</td>
<td>Retraction- Rhomboids, Middle Trapezius</td>
</tr>
</tbody>
</table>
ARM COCKING
ARM COCKING

• From stride foot contact to maximum shoulder external rotation

Stance Leg

Hip: Internal Rotation
Pelvis: Rotates to Face Target
Trunk: Rotates to Target, Abdominal & Oblique
  Muscles on stretch, Lean to Target
Spine: Slight Lordosis

Stride Leg

Quad: Isometric & Eccentric Contraction
Hip: Internal Rotation
ARM COCKING

Shoulder

95° Abduction
Scapula: Retracts, posterior tilt, upper ward rotates
  Muscles: Entire trapezius, levator scapulae, serratus anterior, rhomboids

External Rotation
  Muscles: Infraspinatus, Teres Minor

Internal Rotators
  Muscles: Subscapularis, Pectoralis Major, Eccentric

Compression: All Rotator Cuff Muscles

Elbow

90° Flexion
  Biceps Concentric
  Triceps Eccentric
ACCELERATION

- Transfer Coiled Energy from Lower Extremity and Trunk to Shoulder, Arm, Forearm, Hand
ACCELERATION

• Maximum Shoulder External Rotation to Ball Release
  • Scapula: High Activity in Muscle Stabilizers
  • Shoulder:
    • **Internal Rotator**: Concentric Contraction - Subscapularis, Pectoralis Major, Latissimus Dorsi
    • **External Rotator**: Eccentric Contraction – Teres Minor, Infraspinatus
    • Internal Rotation
ACCELERATION

• **Trunk**: From Extension to Flexion
• **Stride Leg**: Extends
• **Elbow**: Extends
DECELERATION
DECELERATION

- **Stride Hip**: Internal Rotation and Flexion
  - Period of Single Leg Stance
- **Scapula**: Eccentric Contraction All Posterior
  - Scapular Muscles
- **Shoulder**: Eccentric Contraction
  - Max Teres Minor
  - Infraspinatus Lesser
- Distraction Force = Body Weight
  - Restricted by Entire Rotator Cuff
FOLLOW THROUGH
FOLLOW THROUGH

• Maximum Eccentric Contraction
• Posterior Shoulder Muscles
• Rotator Cuff
• Most Overuse Injuries Occur during Deceleration and Follow Through
• Forces must be Dissipated Smoothly
TIME LINE FOR THROWING
FACTS

• 50% of Power comes from Lower Extremities
• Kneeling Can only Throw 50%
• Catch Up
  • Shoulder muscle volume ↑ 80%
  • Shoulder velocity ↑ 37%
• Eccentric Muscle Activity ↓ Muscle Flexibility
HOW DO WE KNOW WHEN THINGS GO WRONG

- Foot Position
- Knee Motion
- Hip Motion
- Trunk Motion
- Scapular Position
- Shoulder/Scapular Motion
- Elbow Position
- Hand Position
WIND UP AND STRIDE
BALL HAND POSITION
TOO MUCH HORIZONTAL ABDUCTION
FUNCTION OF SCAPULA

- Gleno-Humeral Articulation
- Safe Zone 30° Flexion/Extension Scapular Plane
- Retraction/Protraction
- Elevation of Acromion
- Muscle Attachment: Most Efficient Muscle
- Function at 70° to 100° Abduction
- Link for Proximal to Distal Energy Transfer
SCAPULAR DYSKINESIA
SCAPULAR DYSKINESIA
SCAPULA DYSKINESIA
ASSESSING SCAPULA DYSKINESIA

• Must Evaluate entire Kinetic Chain
• Segments
• Lower Extremity
• Pelvis/Hips
• Spine
• Shoulder Girdle (Intrinsic/Extrinsic)
• Upper Arm
SHOULDER ROTATION

• GIRD/TAM
REHAB

• Must Regain ROM
• Must Maintain Flexibility
• Strengthen Proximal to Distal Kinetic Chain
• Core/Hip/Oblique Muscles
• OFF Season Maintenance a MUST
• Continuous ROM/Flexibility/Strength in Season
GOALS MET

• Understand Kinetic Chain
• Kinematics of Throwing
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• Pick Out Breakdown in Throwing Cycle
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QUESTIONS ???

THANK YOU