Biomechanics and Sport Training

1. Principle of specificity, related to biomechanics
2. Technical and physical skills
3. Qualitative anatomical analysis

Principle of Specificity

While training, it is helpful to identify and replicate involved: (1) angular displacement, (2) angular velocity, (3) muscle action type, and (4) external force magnitude.

Physical/Technical

It is helpful to identify physical and technical skill requirements. Some activities are more physical while others are more technical. These two categories usually overlap.

Technical Training

Perform the technique correctly: use the qualitative biomechanical analysis we previously discussed to determine “correct.”

If you cannot perform the technique correctly, perform drills that mimic the technique. Be sure that the drill is representative/specific to the skill.

Physical Training

Improving physical condition:

– Muscular strength, power, and endurance
– Cardiovascular fitness
– Body composition

You must be able to identify what anatomy should be emphasized.

Also, performing the skill is sometimes the best way to improve physical condition.

Qualitative Anatomical Analysis

1. Temporal phases of the skill
2. Joint motions during each phase
3. Muscle action types
4. High accelerations
5. Extreme ranges of motion
1. Temporal Phase Division

- Do it yourself, if you know the skill well, or talk to others
- A video camera may be helpful or necessary
- Study textbooks or coaches manuals

Examples:
- Tennis Serve
- Yurchenko Vault
- Baseball Pitch

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Wind-up</td>
<td>Begins with ball at student's chest and finishes when it reaches the level of shoulder height</td>
</tr>
<tr>
<td>Early Cocking</td>
<td>Continues from ball at shoulder height until maximal shoulder external rotation. Early cocking makes up the first 75% of the motion.</td>
</tr>
<tr>
<td>Late Cocking</td>
<td>Depicted at the last 25% of the entire cocking motion</td>
</tr>
<tr>
<td>Acceleration</td>
<td>Includes maximal shoulder external rotation and entire arm swing</td>
</tr>
<tr>
<td>Early Follow Through</td>
<td>Begins at ball impact and completes when the relaxed arm reaches the fully extended position. Early follow through is the first 25% of the motion.</td>
</tr>
<tr>
<td>Late Follow Through</td>
<td>Late follow through represents the last 75% of the entire follow through motion.</td>
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</tbody>
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2. Identify Joint Motion During Each Skill Phase

3. Muscle Action Types

Identify which muscles are active, and when each muscle is active

Identify corresponding contraction types

4. High Accelerations

Identify events that result in high accelerations. You can employ sophisticated instrumentation or common sense, or both.

- Yurchenko Vault
5. Extreme Ranges of Motion

• Identify events that result in extreme ranges of motion

### Your own training program:

1. Qualitative anatomical analysis
   1. Identify temporal phases
   2. Describe motion
   3. Discuss muscle contraction types
   4. Extreme ranges of motion
   5. High accelerations

2. Training Program:
   1. List the physical and technical requirements...
   2. Which requirements get priority?
   3. How will each requirement be addressed?
   4. Don’t forget to include the activity in your training!!

Summary

• Biomechanics is useful in improving training and performance.
• Specificity requires performance of the skill and/or drills that mimic the skill.
• It is important to distinguish technical from physical skill requirements.
• Qualitative Anatomical Analysis
  – Temporal phases
  – Involved joints and motions
  – Involved muscle and type of muscular contraction
  – High accelerations and impacts
  – Extreme ranges of motion