Developing Maximum Strength for the Throws

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Dimensions of Strength

• Maximal strength
• Power
• Reactive strength
• Strength endurance.

Importance Of Strength Training

• Strength “Ability” To Produce Force (Magnitude And Direction)
• All Movement Depends Upon Strength (Force)
• The Application Of Strength (Force) Also Results In: Rfd And Duration – Dynamic Force Production Also Produces And Power Output And A Velocity
• Athletic Movement Requires Some Degree Of Force, Rate Of Force Development, Speed And Power And Endurance

Strength Training

The load used in an exercise affects the type of strength development which is stimulated

<table>
<thead>
<tr>
<th>REP</th>
<th>MAXIMAL STRENGTH</th>
<th>MUSCLE BULK (Hypertrophy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>if performed slowly:</td>
<td>Endurance</td>
</tr>
<tr>
<td>5-10</td>
<td>if performed fast and explosively with a light load</td>
<td>Power</td>
</tr>
</tbody>
</table>

The Importance of Strength (Force)

• Force is created by muscular contraction
  – Maximum strength = maximum capability of the neuromuscular system to produce force
• Force is the characteristic that causes a mass to accelerate
  – F=ma
• Force is a major component of power
  – Power= F x V
• All movement depends upon force
• Force production results in rate of force development (RFD) and duration
  – Dynamic force production also produces a power output and a velocity
• All athletic action requires force production, rate of force development, speed and power as well as endurance.
Misconceptions

- Strength training reduces flexibility & speed
- Strength training makes you bulky
- Circuit Training provides an aerobic benefit
- Long breaks between exercises decrease their effectiveness

General Adaptations to Strength Training

- Hypertrophy (growth)
- Joint Strength (tendons & ligaments)
- Improved muscle fiber recruitment
  - Improved force of contraction
  - Improved speed of contraction
- Injury prevention (as an end product)

Importance Of Strength Training

- Technique, Motor Control And Strength Are Interrelated Functions Of The Same Construct
  - Technique Results From Applying Force In Appropriate Directions, Magnitudes And Sequences
  - Technique Results From Applying Force In Appropriate Directions, Magnitudes And Sequences

1. Strength Training Can Enhance Learning Technique

2. Strength Training Can Enhance Athletic Performance - Degree Of Enhancement Depends Upon Proper Integration

At Some Point "Technique" Becomes Relatively Stable

Potential Physiological Effects of Strength Training

Neuromuscular system

1. HYPERTROPHY
   - Greater II/I X-Section
   - Changes in architecture

2. NEURAL (supra and spinal adaptation)
   - Reduced cortical activation for an equivalent kinematic or kinetic outcome (Dettmers et al. JAP 92:2309-2318, 2002)

   ENHANCED NEUROMUSCULAR CONTROL
   - FASTER ACTIVATION
   - IMPROVED COORDINATION

Resistance Training

NEURAL AND MUSCLE ADAPTATIONS TO RESISTANCE TRAINING

IMPROVED FORCE, VELOCITY AND POWER CAPABILITIES

IMPROVED SPORTS PERFORMANCE
Neuromuscular Factors Involved In Strength Production

- Motor Unit Recruitment
- Mu Activation Frequency (Rate Coding)
- Synchronization (Ballistic Movements)
- Motor Unit Activation Pattern (Intra-muscular Activation)
- Muscle Action Pattern (Inter-muscular Activation)
- Use Of Elastic Energy And Reflexes
- Neural Inhibition
- Mu Type (Muscle Fibre Type)
- Biomechanical Anthropometric Factors
- Muscle Cross-sectional Area

Adaptations to Strength/Power Training

- Improved motor control
  - Technique results from the correct application of force in the right direction, the right magnitude and the right sequence
  - Improved strength can enhance learning proper technique

Maximum Strength (MxS)

- MxS is perhaps the core quality that all individuals should be concerned with, because it's acquisition is the fastest route to all other motor qualities, including relative-strength, speed-strength, strength-endurance, speed, and speed-endurance.

Loading

Maximal Strength Training

- Hypertrophy (volume) training
  - Intensity: 60 - 80%
  - No of repetitions: 12-8
  - Sets: 4-6

- Recruitment training
  - Intensity: 85 - 100%
  - No of repetitions: 5-1
  - Sets: 4-6

Repetition Chart

<table>
<thead>
<tr>
<th>Repetition Range</th>
<th>Number of Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.9 reps</td>
<td>3-6 sets</td>
</tr>
<tr>
<td>1.0-1.9 reps</td>
<td>4-6 sets</td>
</tr>
<tr>
<td>2.0-2.9 reps</td>
<td>5-6 sets</td>
</tr>
<tr>
<td>3.0-3.9 reps</td>
<td>6-8 sets</td>
</tr>
<tr>
<td>4.0+ reps</td>
<td>7-12 sets</td>
</tr>
</tbody>
</table>
Maximal Strength Training

- **When:** During the whole year
  - **Build up:** general preparation, beginning of special preparation
  - **Maintenance:** second half of special preparation, competition period
- **How often:** 2-3 x per week in GPP
  - 1-2 x per week in SPP and CP
- **What:** General strengthening, weight lifting

General Guideline

- Strength training is part of the training program throughout the year
- Number of sessions, number and type of exercises, volume and intensity will vary according to the training period
- A proper execution of lifting techniques is essential
- Overall body strengthening is essential

Maximum Strength Training

- **Exercises (selection):**
  - Half squat
  - Full squat
  - Front squat
  - Split squat
  - Deadlift
  - High Pull
  - Bench press
  - Pull over (especially for javelin)
  - Incline Bench Press
- **3 - 5 exercises per session**
- **3 - 5 sets per exercise.**

Necessary characteristics for successful application of an exercise:

- **Movement pattern specificity**
  - type of muscle action (eccentric Vs concentric Vs stretch-shortening muscle actions)
  - accentuated regions of force production
  - complexity, amplitude and direction of movement
  - ballistic Vs non-ballistic
- **Overload**
  - Force production
  - Rate of maximum force production
  - Power output

modified from Siff and Verkoshansky 2001 and Stone et al. 2001

Planning Strength and Power Programs

- **Exercises may be:**
  - **General** - non specific exercises aimed at all-round strength and power development e.g. power cleans
  - **Specific** - exercises designed to closely simulate actual throwing movements e.g. throwing overweight implements

A mixture of General and Specific exercises should be used in strength programs. General exercises should be included for beginners and during the general preparation phase. Specific exercises should be predominant in the pre-competition and competition phases.

Developing Maximal Strength

- The same exercise can produce different effects depending on:
  - variations in loads
  - variations in sets and repetitions
  - variations in recovery time
  - variations in forms of execution

- Coaches need to be precise in their choice of exercise, loads and forms of execution keeping the aims of the training phase in mind along with the athletes age and stage of development.
Example of Different Forms of Execution

BENCH PRESS

1. Classic: pronated grip with shoulders wide - flexion and extension
2. Body building: slow with a light weight (50%MR), high repetitions
3. Discus specific: with grip wider than shoulders
4. Shot put specific: grip closer than shoulders
5. Shot put specific: on an inclined bench
6. Plyometric: throw and catch the bar back at the end of extension
7. Exhaustion: as many repetitions as possible
8. Sub maximal: flexion at 110%MR with extension at 80%MR

Maximum Strength (MxS) Training

- Traditional MxS training involves the use of maximal or near-maximal loads, typically 90% of 1RM and above.
- The maximal-load method has validity and a proven track record for results.
- However, load is only one-half of the equation, since it is tension - not load - that provokes anatomical adaptations leading to MxS improvements.
- These adaptations include improved inter- and intra-muscular coordination, as well as more efficient rate-coding.

Time Under Tension

- Tension of course, is the offspring of load and speed.
- High loads, performed at (unavoidably) low speeds produce high tensions - that’s a given.
- Less appreciated however, is the fact that moderate loads, moved at high speeds, also lead to high tensions.
- So as it turns out, there are two distictively different methods that can be employed in your quest for MxS.
- Given what we know about the importance of variety for the sake of preventing physical and psychological stagnation, why not employ both methods?

Maximum Strength Workout A

- Involves heavier loads - 95% or 2RM to be specific.
- (up to) 7 sets of 1, using a 2RM or 95% 1RM weight, resting 3 minutes between sets. As an illustration, if your 2RM on a squat is 374 pounds, that’s your working weight.
- First perform your warm-up sets, and then set your stopwatch for 15 minutes.
- Every 3 minutes, perform one rep, moving as explosively as possible during the concentric phase.
- During this first “A Session,” one of two things will happen - either you’ll hit your 7 sets, or you won’t. If you fail to complete 7 singles (let’s say you got 5 singles and a missed attempt), the next time out, you try to get 6 or (hopefully) 7 singles.
- Continue this procedure until you manage to complete 7 sets of 1.
- If you (or once you) do manage to complete 7 sets, the next time out, add 5 pounds or 5% (whichever is less) to the bar, wipe the slate clean, and start over.

Maximum Strength Workout “B”

- The first session (which we’ll call the “B Session”) features the performance of (up to) 10 sets of 2 reps, using a 4RM or 90% load, resting exactly one minute between sets. As an illustration, if your 4RM on a squat is 352 pounds, that’s your working weight. First perform your warm-up sets, and then set your stopwatch for 15 minutes.
- Every 60 seconds, perform a set of 2 reps, moving as explosively as possible during the concentric phase.
- During this first B Session, one of two things will happen - either you’ll hit your 10 sets, or you won’t. If you fail to complete 10 doubles (let’s say you got 9 doubles and a single), the next time out, you try to get 10 or more doubles.
- Continue this procedure until you manage to complete 10 sets of 2.
- If you (or once you) do manage to complete 10 sets, the next time out, add 5 pounds or 5% (whichever is less) to the bar, wipe the slate clean, and start over.

Maximum Strength Example
Strength training in GPP

• GPP is the period of the year to establish the base for the rest of the year
• Introduce and/or develop the technique of lifting
• Extended general body strengthening
• Volume based maximum strength training.

Strength training in SPP

• Continue with general body strengthening
• Move from volume based to intensity based (recruitment) maximum strength training
• Begin more power training
• Try to link weight training with plyometrics.

Strength training in CP

• Conservation of strength and power
• Reduce the number of strength sessions
• Use high and very high loads (except in inexperienced athletes).

Mesocycle Sequencing

• The mesocycle sequencing of exercises begins with stability work in the general preparation phase, hypertrophy methods in the specific preparation phase, progressing into strength-building methods in the pre-competitive phase, followed by neural activation methods in the competitive phase, and finally speed-strength methods in the peaking phase (Poliquin, 1989; Schmidtbleicher, 1992).

Phase Potentiation
SUMMARY: SPECIFICITY OF STRENGTH/POWER TRAINING (PERFORMANCE)-TRAINED

TYPE OF TRAINING: PRIMARY ADAPTATION

HIGH FORCE/LOW VELOCITY (HEAVY WT TRAINING)
DIMINISHED OR LITTLE GAIN IN MAX STRENGTH, DF/3 POWER

SPEED: STRENGTH TRAINING
INCREASED RP AND POWER

INTENTIONALLY SLOW MOVEMENTS
DIMINISHED OR LITTLE GAIN IN MAX STRENGTH, DIMINISHED HP AND POWER

SEQUENCED TRAINING
INCREASED POTENTIAL FOR GAINS


Training contents Power Events

Annual distribution of contents

weeks

Strength Distribution

MAX ST EXPLOSTIC ST SPECIAL ST

Muscular development

Exp. St Exp St Sp St Sp St Sp St Sp St

Intramuscular coordination

Specific Strength

Specific Skillful Strength
To Develop Maximum Power, Explosive Strength, Proprioceptive Strength (Implement not Released)
Exercises including specific strength machine drills, Bundachos, one arm and double arm flies, release movement imitations with or without implements, quick successive rotations, etc.
Turning Drills

Specific Throwing Strength

Specific Throwing Strength: To Develop Explosive Strength, Speed Strength, Reflexive Strength (Implement Released)

Exercises including kettle bell put or throw, overhead shot throwing forward and backward, rotational medicine ball put, sling bar bell plate, heavy and light implements throw, rubber ball throw forward net or wall, etc.
Questions?? www.coachlarryjudge.com

Thank you for your attention and contribution.