ESSENTIALS OF STRENGTH TRAINING AND CONDITIONING MULTIMEDIA SYMPOSIUM

Presentation 6:

Speed Development and Plyometric Training

by:

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MULTIMEDIA SYMPOSIUM OVERVIEW

This multimedia symposium was developed for the specific purpose of providing individuals who sit for the Certified Strength and Conditioning Specialist® (CSCS®) certification exam with a review of facts, concepts, and theories that are relevant to strength training and conditioning.

You are encouraged to **simultaneously** listen and watch the symposium video presentation, view the PowerPoint® slide show, follow along in the presentation outline, and add your own notes in the spaces within the outline (more paper may be necessary).

To maximize the value of the multimedia symposium when preparing for the CSCS exam, you may find it helpful to first study the *Essentials of Strength Training and Conditioning* (2nd edition) text. Further, candidates who perform well on the CSCS exam typically have considerable practical experience in strength training and conditioning athletes (e.g., designing programs, teaching proper exercise technique, performing testing sessions) and a strong academic background in the exercise sciences (i.e., anatomy, physiology, biomechanics, etc.). For additional suggestions for preparing for the CSCS exam, go to www.nsca-cc.org.

NOTICE:

• Although this presentation was recorded live and then professionally edited for scope and length, there are some room sounds, voice fluctuations, abrupt video "cuts" and piecing of video clips, and content variations. Every possible effort was made to minimize these irregularities.

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• While comprehension of the information provided by the multimedia symposium should certainly increase the likelihood of passing the CSCS certification exam, it does not guarantee a successful performance. The questions on the CSCS exam are developed from numerous resources in addition to the multimedia symposium.

SPEED DEVELOPMENT

I. What is Speed?

A. Definitions

1. Start speed

2. Acceleration

3. Maximum (absolute) speed

4. Speed of recognition

5. Anticipation

6. Creativity

II. Components of Running Speed

A. Stride frequency: number of strides per unit of time

B. Stride length: the distance covered per running stride

III. Running Stride Analysis

A. Research findings by Dr. Ralph Mann during ***The Elite Athlete Project for Sprints and Hurdles*** reveals the following general conclusions:

1. Short duration (100 meters) speed success is a function of leg strength

2. Longer duration sprints (200 meters) show that efficiency of technique becomes a more important factor

3. Female athletes demonstrate a significant weakness in the hamstrings as compared to their male counterparts

4. Elite sprinters show significantly less ground touchdown times than others

5. Elite sprinters show greater plantar flexor forces prior to and throughout ground contact

IV. Framework for the Preparation of a Sprinter (as recommended by Frank Dick, British National Coach)

A. Phase I: Physical preparation

1. Improve overall work capacity

2. Ensure normal range of motion: joint mobility vs. flexibility

3. Increase basic strength of the extremities

4. Improve core strength

5. Develop running endurance

6. Improve general speed coordination

B. Phase II: Develop basic sprint technique

1. Improve specific strength

2. Develop specific short-term endurance

3. Improve specific conditioning and metabolism

4. Develop specific mobility

C. Phase III: Develop advanced techniques

1. Focus on explosive starts

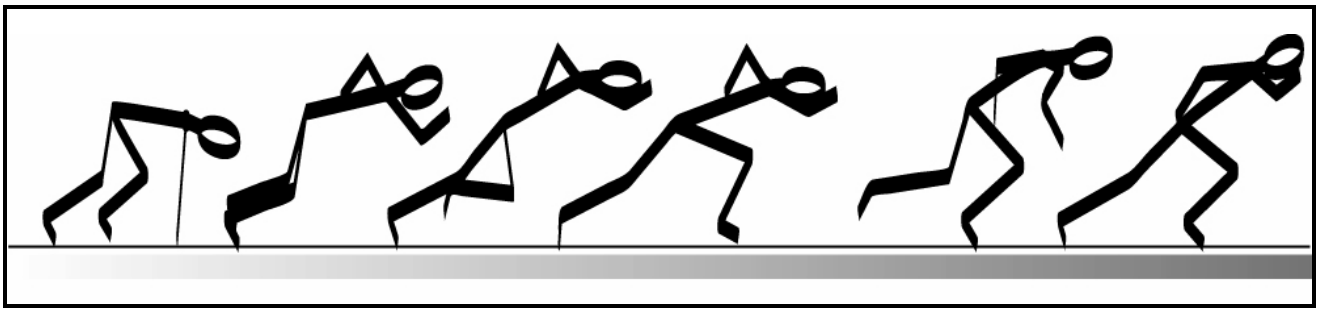
2. Develop appropriate stride patterns

3. Improve lifting techniques and efficiency of running

4. Develop race experience and tactical approaches

V. Components of the Running Stride

A. Start/acceleration (Figure 1: *top*); the first 3 strides



1. Center of gravity (c.o.g.)

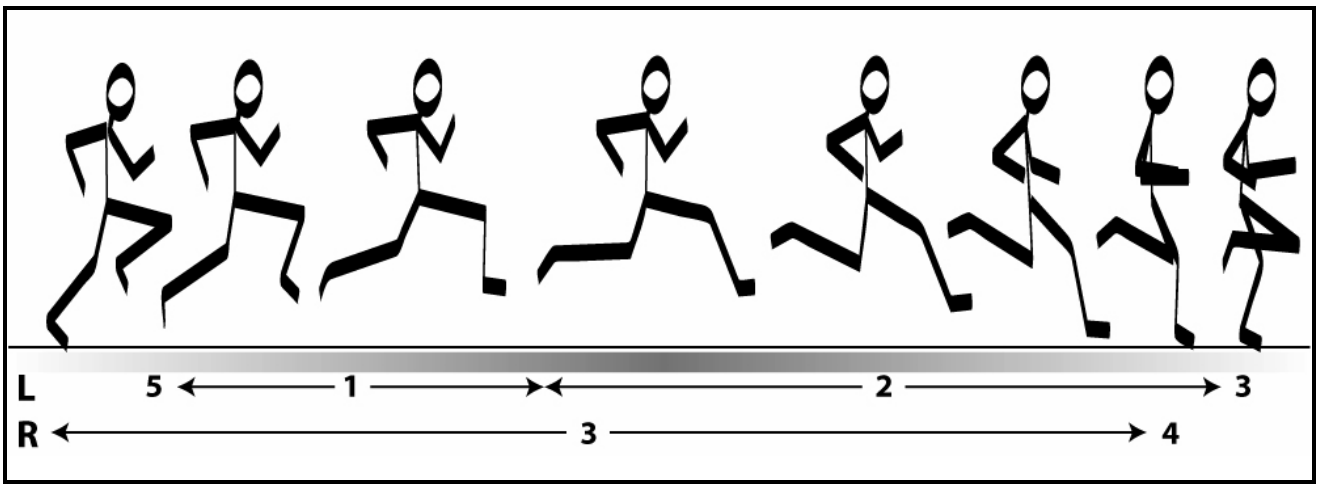
2. Angles of joints

3. Explosive start strength

4. Body lean position

5. Reciprocal arm drive

B. Maximum velocity (Figure 1: *bottom*)



1. Reach max velocity within 40-60 meters

2. Actual stride length vs. effective stride length

3. Lack of vertical translation of c.o.g.

4. Phases and (their) muscular involvement

   a. Early flight

   b. Mid-flight

   c. Early support

   d. Late support

VI. Technique Drills to Improve Speed

A. Teach during Phase I

B. Use form running drills to improve motor coordination

1. Marching drills

2. Skipping

3. Arm action

4. Running posture

C. Observe the athlete from "ground up"

1. Foot

2. Ankle

3. Knee

4. Hip

5. Pelvis

6. Torso

7. Arm action

VII. Speed-Endurance Development

A. Goals

1. Develop the ability to maintain running speed

2. Repeatedly reach maximum acceleration in multiple sequential sprints

3. Maintain maximum velocity throughout the race

4. Avoid deceleration

B. Types of speed-endurance training workouts

1. Extensive intervals

2. Intensive intervals

3. Repetitions

4. Competitive trials

VIII. General Considerations for Speed-Specific Training Programs

A. Training distance

B. Intensity (speed)

C. Recovery interval

D. Work:rest ratio

E. Volume (sets and repetitions)

IX. Specific Resistance Training for Speed Development

A. Low back

1. Romanian deadlift

2. Good morning exercise

3. Overhead squat

B. Glutes and hamstrings

1. Back squat/front squat

2. Split squat/lunge

3. Multi-directional lunge

4. Step up and over

5. Retrograde running

C. Hip flexors

1. Pulley exercises

2. Split squat walk

3. Split jerk

D. Lower leg

1. Calf raises (4-way)

2. Seated calf raise

3. Dorsiflexion pull

E. Total body

1. Power clean

2. Push press

3. Front squat to push press

4. Pulley drills/dumbbell drills for arm action

PLYOMETRIC TRAINING

I. Plyometric Training

A. Activities that enable a muscle to reach maximal strength in the shortest possible time

1. "Shock training"

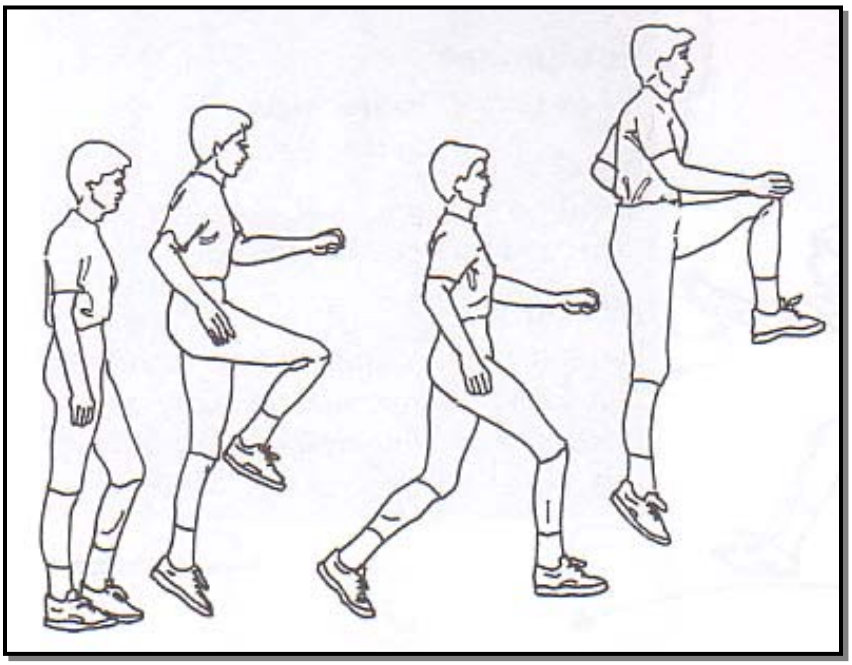
2. Plyometric = "measurable increases"

B. Purpose: utilize the elastic components of muscle and tendon, as well as the stretch reflex, to increase the power of subsequent movement

II. Stretch-Shortening Cycle (SSC)

A. Definition/description

B. Three phases (a partial application example is seen in Figure 2)



1. Eccentric

2. Amortization

3. Concentric

III. Categories of the Jump Response

A. Short response

1. 0.1-0.25 seconds at take-off

2. Small angular displacement

3. Ground contact at sprint velocity

4. Examples

B. Long response

1. >0.25 seconds at take-off

2. Large angular displacement

3. Ground contact related to acceleration

4. Maximum force development requires 0.5-0.8 seconds

5. Examples

IV. Categories of Jumps

A. Jumps in place

1. Description

2. Long response jump example

3. Short response jump example

B. Standing jumps

1. Description

2. Short response jump example

3. Long response jump example

C. Multiple hops and jumps

1. Description

2. Short response jump example

3. Long response jump example

D. Bounding

1. Description

2. Long response jump example

3. Short response jump example

E. Depth jumps

1. Description

2. Short response jump example

F. Sport-specific drills

1. Description

2. Short response jump example

3. Long response jump example

V. Upper Extremity Plyometrics

A. Medicine ball push-up

B. Offset push-up

C. Triceps push-up

D. Walkabout

E. Depth jump

F. Power drop

VI. Plyometric Program Design

A. Proper sequence in program design

1. Evaluate athlete: age, gender, training history

2. Establish goals

3. Establish training cycle length

4. Teach or demonstrate proper technique

5. Progress from lower to higher intensities based on:

a. Height of jump

b. Distance covered

c. Speed of movement

d. Complexity

B. Recovery

1. For lower intensity workouts/drills

2. For moderate to high intensity workouts/drills

C. Program variables

1. Volume

2. Intensity

3. Frequency

4. Progression

5. Warm-up

VII. Plyometric Injury Prevention

A. Consider the athlete

B. Select an optimal landing surface

C. Begin with an initial strength base

D. Practice common sense

GLOSSARY OF TERMS

Flight phase—the period of time when the feet are not in contact with the ground while running; includes two sub-phases: 1) drive leg take-off (body's c.o.g. rises to its highest point); 2) descent of body's c.o.g. (ground contact)

Form running drills—drills that improve leg turnover (stride frequency) by emphasizing correct running form and ingraining efficient/error-free neuromuscular movement patterns

[In-]depth jump—plyometric drills characterized by shock-intensity level

Interval training—high-intensity exercise bouts alternated with recovery designed with reference to a sport's primary energy system or work: relief pattern

Plyometrics—exercises characterized by stretch-shortening cycle actions enabling muscle(s) to achieve maximal rates of force development and gain stiffness regulation; intended to improve reactive/explosive qualities of strength intervals

Speed-endurance—the ability to maintain running speed after 1-2 seconds at maximal velocity (5-6 seconds from a static start); or to achieve maximum acceleration/speed during repeated sprints

Speed-strength—the ability to rapidly develop maximum force and to exert force during high-speed movement

Sprint-assisted training—running with increased linear speed via downhill running or towing

Sprint-resisted training—running with increased resistance via up hill/stair running, harness/sled braking

Stretch-shortening cycle—impulsive eccentric-concentric coupling where rapid deceleration of a mass (via muscle lengthening) is immediately followed by amortization and acceleration in the opposite direction (via muscle shortening); can be classified by response time

Stride frequency—the number of strides taken in a given time while running

Stride length—the distance covered in one stride while running

Support phase—the period of time from touchdown to take-off of the same foot while running; includes three sub-phases: heel-strike, mid-stance, and take-off

POSITION STATEMENT
Explosive Exercises & Training
***NSCA Journal* 15(3): 6. 1993.**

It is the position of the National Strength & Conditioning Association that:

1. Resistance exercises characterized by maximal or near maximal rates of force development or by high accelerations, usually referred to as "explosive exercises," are effective for enhancing physical performance.

2. Explosive exercises may be necessary for optimal physical conditioning in some sports, particularly those involving high accelerations.

3. In keeping with the principle of specificity of training, explosive exercises can be used to simulate movement patterns and velocity and acceleration patterns of many sports movements.

4. Explosive exercises should be taught by experienced and knowledgeable instructors.

5. When properly taught and supervised, explosive exercises do not involve excessive risk of injury.

6. Reduction of athletic injury risks associated with participation in sports involving high rates of force development or high accelerations probably require some training with exercises involving high rates of force development or high accelerations.

POSITION STATEMENT
Explosive/Plyometric Exercises
NSCA Journal **15(3): 16. 1993.**

It is the position of the National Strength & Conditioning Association that:

1. The stretch-shortening cycle, characterized by rapid deceleration of a mass followed almost immediately by rapid acceleration of the mass in the opposite direction, is essential in the performance of most competitive sports, particularly those involving running, jumping, and rapid changes in direction.

2. A plyometric exercise program that trains the muscles, connective tissue, and nervous system to effectively carry out the stretch-shortening cycle can improve performance in most competitive sports.

3. A plyometric training program for athletes should include sport-specific exercises.

4. Carefully applied plyometric exercise programs are no more harmful than other forms of sports training and competition, and may be necessary for safe adaptation to the rigors of "explosive" sports.

5. Only athletes who have already achieved high levels of strength through standard resistance training should engage in plyometric drills.

6. Depth jumps should only be used by a small percentage of athletes engaged in plyometric training. Athletes weighing over 220 pounds (100 kg) typically should not depth jump from platforms higher than 18 inches (46 cm).

7. Plyometric drills affecting a particular muscle/joint complex should not typically be performed on consecutive days.

8. Plyometric drills should not be performed when an athlete is fatigued. Time for complete recovery should be allowed between plyometric exercise sets.

9. Footwear and landing surfaces used in plyometric drills must have good shock-absorbing qualities.

10. A thorough set of warm-up exercises should be performed before beginning a plyometric training session. Less demanding drills should be mastered prior to attempting more complex and intense drills.

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INDEX TO IMAGE REFERENCES

IMAGE NO. F = figure	TITLE OF IMAGE	IMAGE REFERENCE
F1	Sprinting Technique: The Start and Initial Acceleration (*top*) and Maximum Velocity (*bottom*)	© 2006 NSCA Certification Commission.
F2	Illustration of Plyometric Exercise (Skipping)	

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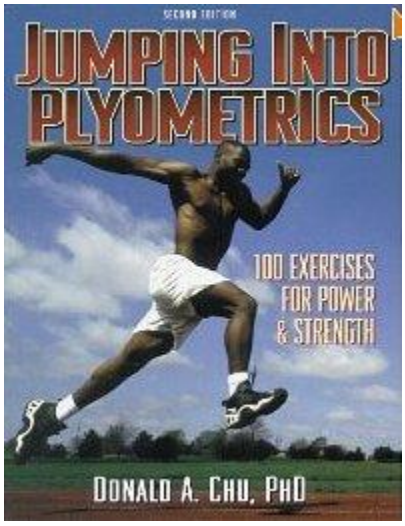

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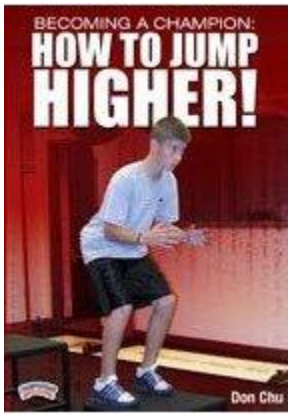

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