The Theory of Sport Training
Lesson 6

Speed and Strength

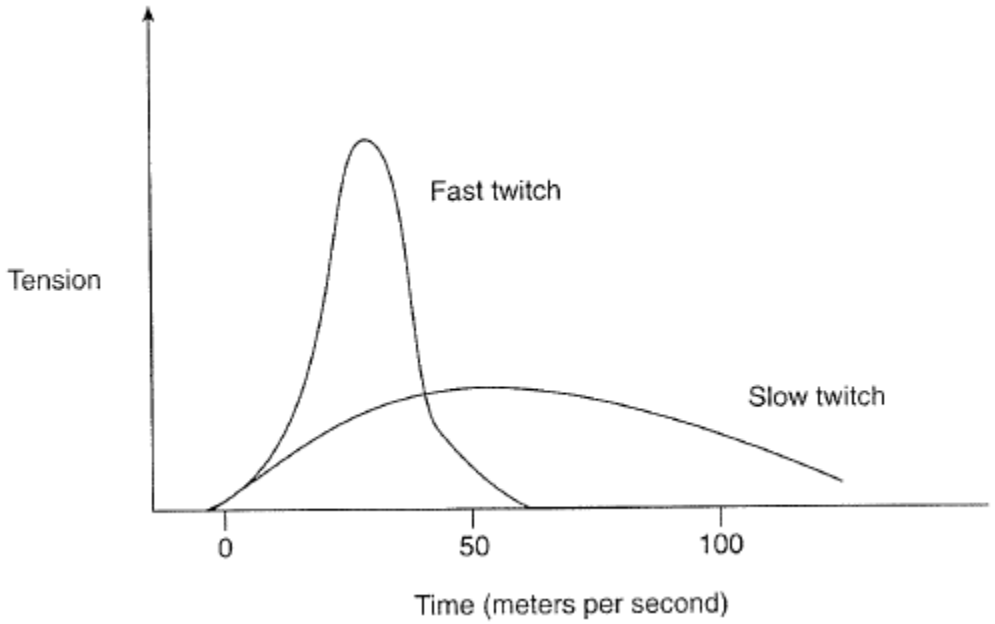
Strength

- What is the strength …

- The aims of strength training:
  - development of performance for competitive sport
  - injury prevention and rehabilitation
  - general bodybuilding, stabilize the muscle apparatus for well-being, health, fitness
  - cosmetic training – visage, appearance

Strength

- Precondition of good strength ability
  - fast and slow fibres
  - the number of fibres recruited to the work
  - quality of neural system and neuromuscular system
  - size of the muscles cross-sectional area
  - number of muscles and groups involved to the movement and coordination of working muscles
  - coordination of working and opponenting muscles
  - energy system



Twitch response of fast-twitch and slow-twitch fibers to the same intensity of stimulus.

Type of contraction

- Dynamic
- Concentric – shortening of the muscle
- Eccentric – stretching of the muscle
- Isokinetic – constant movement velocity, the change of force size

- Static or isometric – the change of the force without the change of muscle length

Type of strength

Along the size of weight (resistance), speed of motion and time (number of repetition) of physical activity

- Maximal strength, submaximal s.
- Dynamic or explosive strength, speed strength
- Strength – endurance

Strength development

- General strength – basic anatomical adaptation, preparation for specific training

- Specific strength – typical for every sport, games, the development of specific muscles groups important for given sport, games , specific dynamic characteristic and time of load

Methods

1. **Development of maximal strength**
   Method of maximal effort
   Method of submaximal effort
   Eccentric method

2. **Development of strength endurance**
   Intemitent method
   Method of submaximal effort
   Strength-endurance method

Methods

3. **Explosive and speed strength**
   Plyometric method
   Speed method
   Explosive method

Circuit training ????

Recommended load of strength training

Variable	Training goal				
	Strength	Power	Hypertrophy	Endurance	Speed
Load (% of 1RM)	80- 100	45-60	60-80	40-60	30
Reps per set	1-5	1-5	6-12	13-60	1-5
Sets per exercise	4-7	3-5	4-8	2-4	3-5
Rest between sets (mins)	2-6	2-6	2-5	1-2	2-5
Duration (seconds per set)	5-10	4-8	20-60	80-150	20-40
Speed per rep (% of max)	60-100	90-100	60-90	60-80	100
Training sessions per week	3-6	3-6	5-7	8-14	3-6

Adaptation to the strength training

- The phases of muscle adaptation to the strength training:

  1. better coordination between muscles , after two week
  2. inside muscle coordination – fibres, after 6 – 8 weeks
  3. hypertrophy, after month, years

Strength training and muscular adaptation

- Anatomical adaptation
  - increase the oxidative capacity of muscles
  - strengthen tendons, ligaments and joints
  - increase the bone mineral content

- The aim: progressive adaptation of the athlete body for demanding training

Strength training and muscular adaptation

- Hypertrophy
  - hypertrophy – fast and slow fibres
  - increase of cross-sectional area of muscles
  - increase storage capacity for high-energy substrates and enzymes

Strength training and muscular adaptation

- Maximal, submaximal strength:
  - depend on the diameter of cross-sectional area
  - capacity recruit fast twitch fibres
  - ability to synchronize or simultaneously call into action all primarily involved muscles in right moment

Strength training and muscular adaptation

- Conversion (transfer)
  -depend on sport – type of muscular work, level of resistance
  - include movement pattern, force production, velocity
  - conversion to the power

Principles of strength training

- To train movements, not muscles
- Train core strength before extremity strength
- Build strength from the bottom up
- Complex movements, that enhance linkage among the all joints
- Sensibly vary the mode and the load
- The systematic, intensive and regularly strength training can start after maturity

SPEED

- What is the speed ability….

- High hereditary determined
- Factors which determined speed:
  - genotype , somatotyp, composition of the muscle, ability to use the energetic source, neuromuscular work,

Speed

- Factor which affects the results of speed during performance:

  - frequency
  - strength
  - technique (coordination)

Biology base of preconditions

- CNS
  - the quality of neural system, primarily – irritation, the velocity of irritation conduction, velocity of information transfer and control of neural-muscular activity

Biology base of preconditions

- Muscle system:
- the length of muscle tissue and fascias, number of sarcomas , and the angle of the muscle tissue under which are fasten to the bone
- inter- and intramuscular coordination high rate of FG and the ability of very quickly change of tension and release (70-80%)
- FOG are important for speed endurance
- Optimal rate of flexibility for realization of the technique in full range of demanding movement

Biology base of preconditions

- Energy system
- High store of CP for resynthesis ATP and partly the store of carbohydrates

- Psychological preconditions:
- Image about right movement – idea about the course of movement
- Ability of high concentration
- High emotional stability

Characteristics of fast – twitch tissue

- Fast to fatigue
- They are innervate from large nerve cell- and can innervate from 300 to more than 500 muscle fibres
- Develops short, forceful contractions
- Recruited only during high – intensity work

Type of speed

- Speed of reaction and speed of the movement accomplishment
- Cyclic or acyclic
- Linear or nonlinear (multidimensional)

Reaction

- Type of reaction
  - simple
  - selective
- 50-60% of hereditary conditioned
- Training can improve selective reaction time aproximately by 20 - 30 %
- The kind of stimuli:
  - visual – reaction time of athletes 0,15 – 0,3 s
  - auditory -0,07 – 0,15 s
  - kinaesthetic – 0,1 – 0,15 s

Linear speed

- Sports?
- Concept of training- from point of speed

- frequence
- start - reaction,
- acceleration – dynamic strength, power
- max. speed, absol. and explosive strength
- speed maintenance

Multidimensional speed

- Sports?
- Agility, quickness
- Factors – perception, decision, dynamic strength, speed, coordination, ability to change direction and speed- connected with balance
- Concept of training:
  - coordination, technique, reaction,
  - max. speed
  - quick change of direction, change of speed, high variability of movement
  - dynamic strength, max. strength

Method

Repetition

Low number of exercise during TS

Sufficient time for rest

If start the fatigue demonstration- stop training

Strength

- Biomechanical preconditions:
  - affectivity of muscular work
  - place of the muscle tendon attachment (fixing) to the bone
  - difference between short and long muscles for resistance activity