



Strength Training for Rowing

Dan Cleather, MA, CSCS, ASCC
Strength and Conditioning Coach
English Institute of Sport





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Rationale

What is the training aiming to achieve?

- Importance of critical evaluation
 - Demands of sport (needs analysis)
 - Profile of athlete (needs analysis)
 - Characteristics of training
- Specify training goals
- Which facets of training are aimed at which goals?
- Is this the most efficient way to achieve these goals?



Rationale: Sports science

Needs analysis

- Analysis of rowing
 - 2 km (6-10 mins)
 - Aerobic
 - VO_2 max
 - Lactate tolerance
 - Power endurance
 - Strength
 - Speed
- Athlete characteristics
 - Elite
 - Novice athlete
 - Junior





Rationale: Sports science

Why strength train?

- Performance enhancement
 - Power
 - Recruitment
 - Coordination
 - Hypertrophy
 - Posture
 - Strength
 - Kinaesthetic awareness/motor control
 - Flexibility
 - Strength
- Injury prevention
 - Strength
 - Posture
 - Strength
 - Kinaesthetic awareness/control
 - Flexibility
 - Flexibility

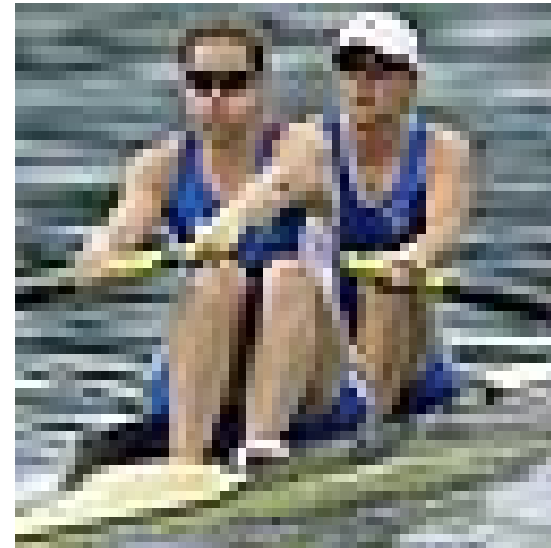


Rationale: Sports science

How strong do rowers need to be?

Strength to body mass ratios

Lift	Men		Women	
	Club	Olympic	Club	Olympic
Squat	1.4	1.9	1.25	1.6
Deadlift	1.4	1.9	1.25	1.6
Bench Pull	1.05	1.3	0.95	1.2



Source: McNeely et al. (2005)

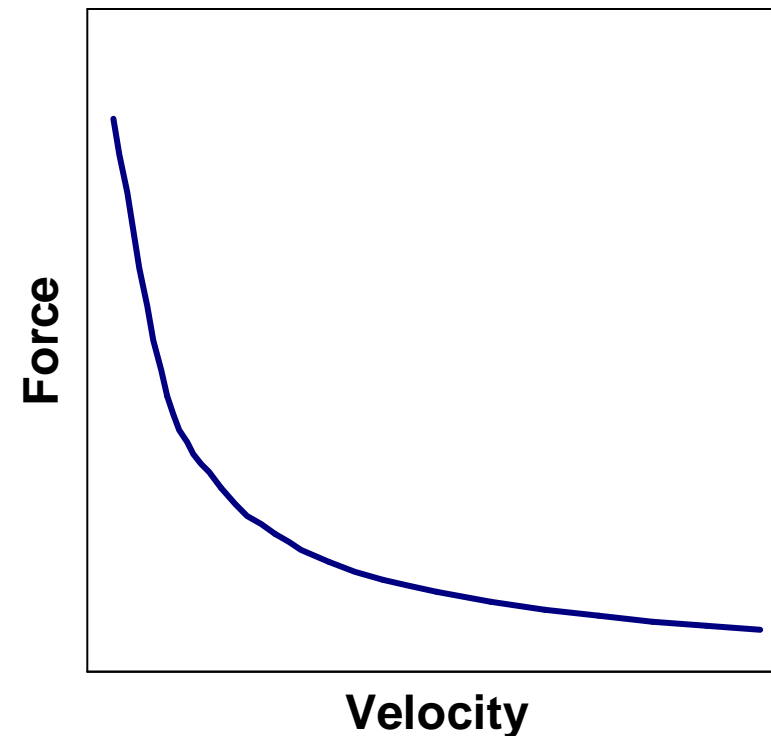


Rationale: Sports science

Force-velocity considerations

- Strength components
 - Max strength
 - Strength speed
 - Speed strength
 - Max speed
- Examples
 - Maximum squat
 - Olympic weightlifting
 - Medicine ball throws
 - Sprinting

Force versus velocity



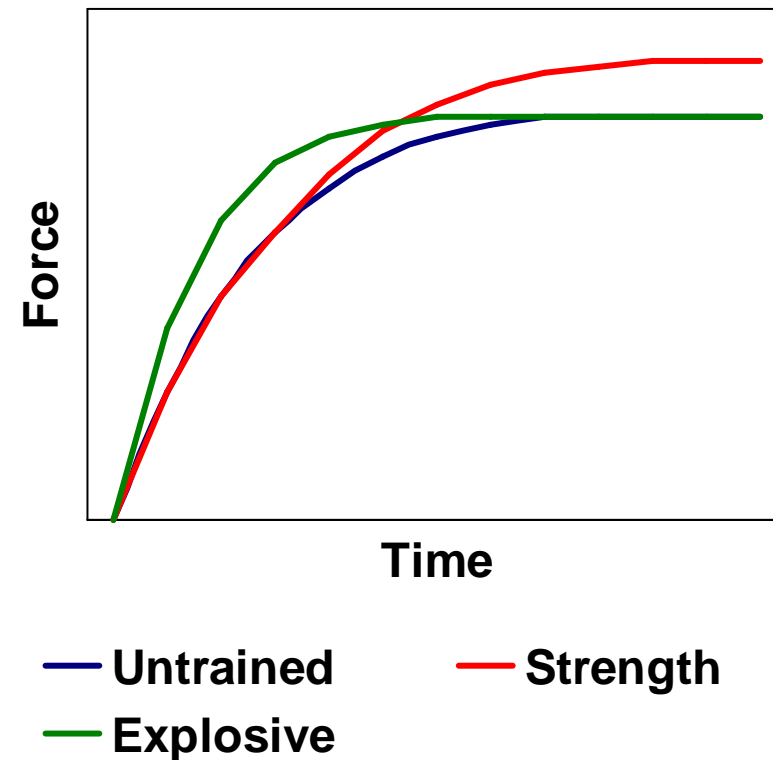


Rationale: Sports science

Force-velocity considerations

- 3 curves
 - Untrained athlete
 - Slow gains at sub max force
 - Max strength trained
 - Faster gains at max levels
 - Explosive trained
 - Faster gains but no increase in max force

Force versus velocity





Rationale: Training modalities

Selection of training modalities

- Fitness is composed of many facets
 - Aerobic
 - Anaerobic
 - Strength
 - Power
 - Flexibility
- Many different modalities for each facet
- Need to evaluate each modality based on your goals

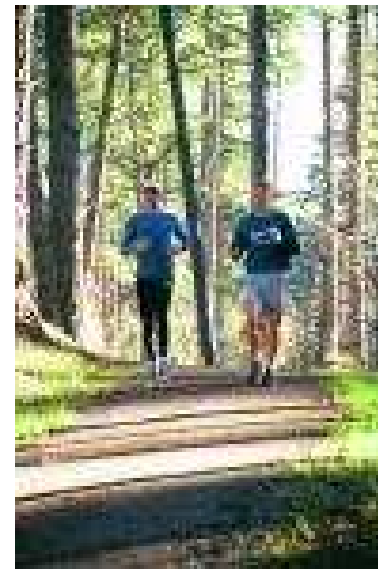




Rationale: Training modalities

Metabolic training

- Cardiovascular training
 - Aerobic
 - Anaerobic
 - Lactic
 - Alactic
- Many different modalities
 - Water
 - Ergo
 - Cross training





Rationale: Training modalities

Resistance training: Muscular Endurance

- Trained on the water
- And in the weight room (>12 reps)
- Correlation between 1RM and 12RM
 - But if load is less than 25% of 1RM no correlation
 - Must be careful to distinguish between muscular endurance, lactic tolerance and aerobic fitness





Rationale: Training modalities

Resistance training: Muscular Endurance

- Circuit training
 - Characterised by timed periods of activity punctuated by regular short rest intervals
 - Commonly involves the use of resistance exercise
 - Research supports
 - Increased cardiovascular fitness particularly lactic systems
 - Increased muscular strength/endurance
 - However, represents a compromise between pure cardiovascular and strength training
 - May be less useful for elite athletes



Rationale: Training modalities

Resistance training: Strength

- Many modalities
 - Isotonic
 - Isometric
 - Isokinetic
 - Free weights
 - Machines
- Considerations
 - Sets and reps
 - Tempo
 - Rest
- Most commonly perform isotonic free weight activity
 - Best dynamic strength stimulus
 - Core control
- Technique
- Injury prevention



Rationale: Training modalities

Resistance training: Power

- Many modalities
 - Olympic weightlifting
 - Free weights
 - Plyometrics
- Importance of velocity
 - Reps
 - Rest
- Training power endurance





Rationale: Training modalities

Core training: Strength, stability and control

- Importance of core training
 - Strength
 - Stability
 - Control
- Trunk strength
 - Abdominals
 - Back
 - Rotation
- Shoulder prehabilitation
- Free weight exercise involves a core component
- Traditional exercises
 - Sit ups
 - Crunches
 - Hyperextensions
- Medicine ball work
- Control exercises



Rationale: Training modalities

Core training: Instability and isolation drills

- Instability training¹
 - Poor transfer of balance skills
 - Reduces chance to handle load²
 - Dangerous
- TVA and multifidus drills
 - Research based on patient populations
 - Spinal stabilizers work in harmony (guy ropes)³
 - Not performance enhancing⁴



1. Willardson (2004)

2. Chiu (2005)

3. McGill (2002)

4. Tse, McManus and Masters (2005)



Rationale: Sports science

Repetition ranges and work/rest ratios

Repetition ranges

Goal	Reps	Sets	Rest
Strength	1-6	2-6	2-5m
Power	1-5	3-5	2-5m
Hypertrophy	6-12	3-6	0.5-1.5m
Muscular Endurance	>12	2-3	<0.5m

Work/rest ratios

Energy System	Ratio	Time
Phosphagen	1:12-20	5-10s
Anaerobic	1:3-5	15-30s
Anaerobic & Aerobic	1:3-4	1-3m
Aerobic	1:1-3	>3m



Rationale

What is the training aiming to achieve?

- Importance of critical evaluation
 - What is the most efficient selection of training modalities to achieve my goals?
- My opinion
 - Elite athletes
 - Metabolic conditioning performed on water and the ergo, weight room is used for strength training
 - Club athletes
 - Individual specific
 - However, in many cases if an athlete is spending time in the weight room, it may be most efficient to pursue classic strength training.



Exercise technique

Olympic Weightlifting: Rationale for its use

- Force vs Power
- Limited time available for the development of force
 - e.g. Ground contact time in sprinting is 0.08 – 0.12s
- Importance of speed
 - RFD
 - Power
 - Elastic energy

$$F = ma$$

$$W = F \times d$$

$$P = \frac{\Delta W}{\Delta t}$$

$$\Rightarrow P = \frac{\Delta F \times d}{\Delta t}$$

$$\Rightarrow P = F \times \frac{\Delta d}{\Delta t}$$

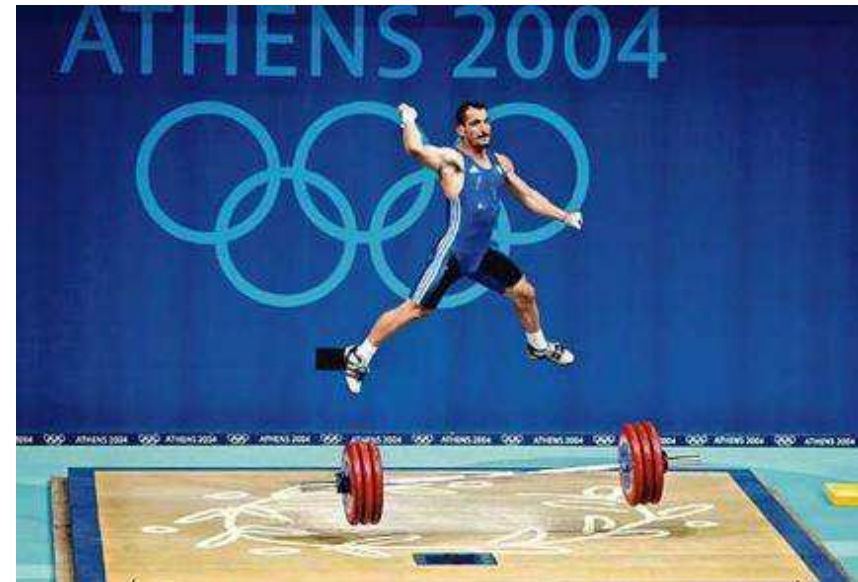
$$\Rightarrow P = F \times v$$



Exercise technique

Olympic weightlifting: Power development

- Speed of execution
 - Clean/snatch pull – $0.8s^{-1}$
 - Jerk drive – $0.2s^{-1}$
 - Second pull – $0.2s^{-2}$
- Characterised by very high power outputs
 - e.g. peak power output of $6953W$ in the jerk³
 - 1 horsepower = $746W$
- RFD
 - e.g. acceleration



1. Garhammer and Takano (1991)
2. Garhammer, Kauhanen and Hakkinen (2002)
3. Garhammer (1985)



Exercise technique

Olympic weightlifting: Relevance to rowing

- Total body movement
 - Muscular involvement
 - Inter/intra muscular coordination
- Power position
- Hip extension

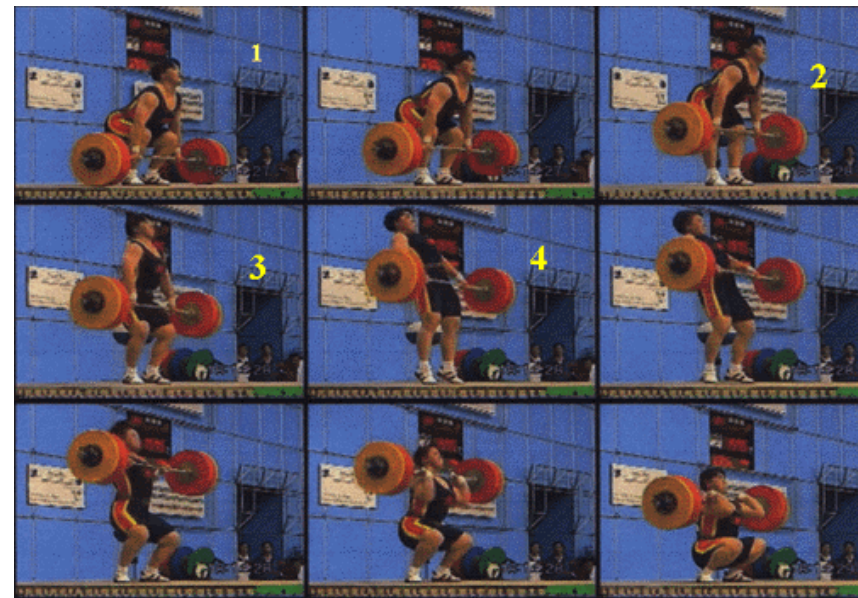




Exercise technique

Olympic weightlifting: Technique

- Power clean technique
 - First pull
 - Scoop (transition)
 - Second pull
 - Catch
 - Recovery

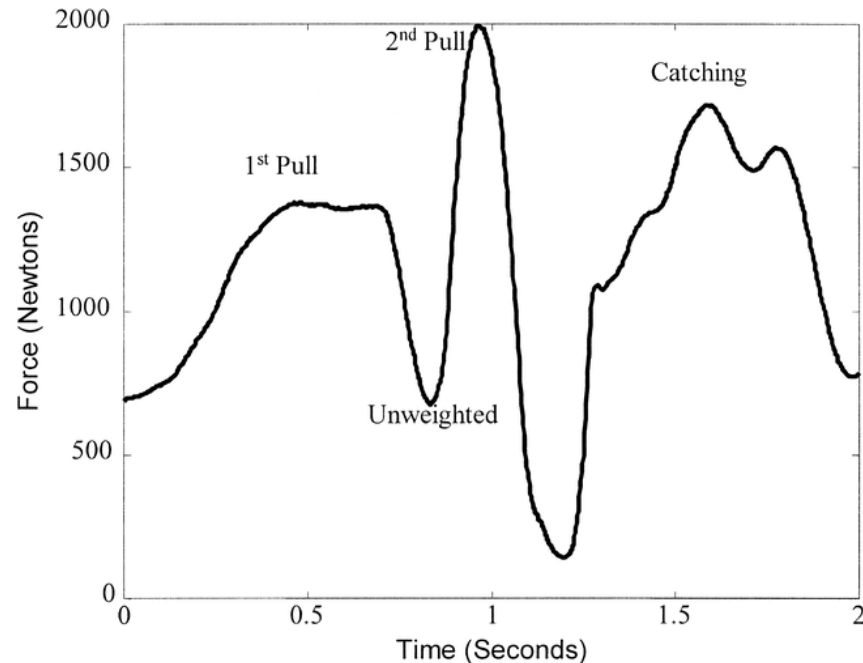




Exercise technique

Olympic weightlifting: Ground reaction force

- Souza, Shimada and Koontz (2002)
- Clearly illustrates first and second pulls
 - First pull is clearly longer
 - Second pull involves a greater application of force
 - Second pull results in a much greater power output

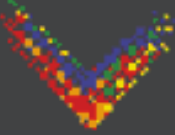




Exercise technique

Olympic weightlifting: Summary

- Importance of technique
 - Second pull
 - Injury prevention
- Importance of good coaching



Exercise technique

Olympic weightlifting: Alternatives

- Squat jumps
- Medicine ball throws
- Plyometrics
- Sprinting
- Other explosive activities



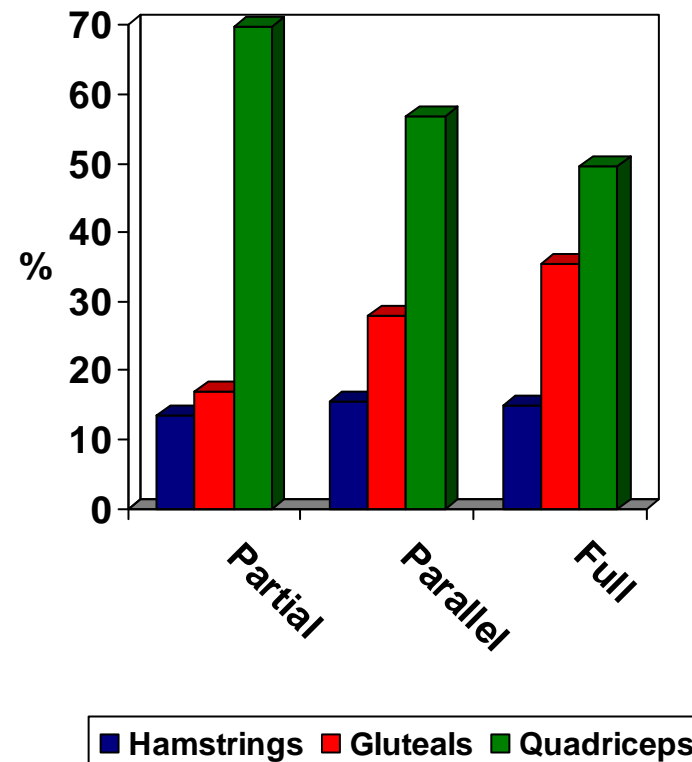


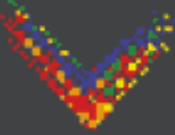
Exercise technique

Squatting: What depth?

- Caterisano et al (2002)
 - Deeper squats involve more activation of the glutes and hamstring
- Wretenberg, Feng and Arborelius (1996)
 - Knee moment is 191Nm for deep versus 131Nm for parallel squat
 - But mass lifted is correlated with the hip moment

EMG activity in the squat ascent





Exercise technique

Squatting: What depth?

- Deep squat
 - Safer
 - Greater hamstring and glute activation
 - Promotes flexibility
- Shallow squat
 - Often poor technique
 - Poorer leverage at start of ascent





Periodization: Rationale

- Systematic progression of phases will lead to greater return than pursuing the same programme year round
- Break the year into training phases
 - Macrocycle
 - Mesocycle
 - Microcycle
- Aim to peak for major competition



Principles of programme design

Periodization: Linear and conjugate

- Linear
- Classic strength training periodization
 - Hypertrophy
 - Strength
 - Power
- Disadvantages



Principles of programme design

Periodization: Conjugate

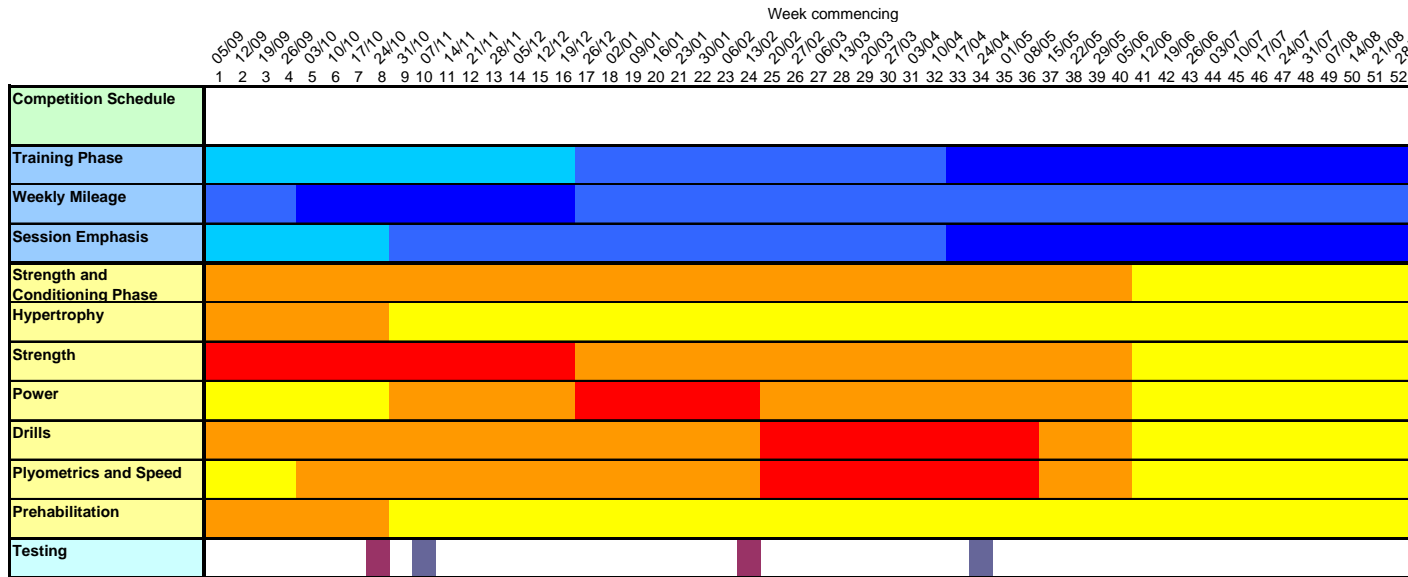
- Principle of training all qualities simultaneously
 - Hypertrophy
 - Strength
 - Power
- A series of conjugate mesocycles can be linearly periodized
- Variety of ways of utilizing a conjugate periodization
 - Within a workout
 - Within a week
 - Within a mesocycle (pendulum)



Principles of programme design

Periodization: Conjugate

Strength and Conditioning Annual Plan



Key

- Competition Priority: Low (light green), Medium (medium green), High (dark green)
- Training Phase: GPP (<40, light blue), SPP (40-60, medium blue), Peaking (60-80, dark blue), >80 (darkest blue)
- Weekly Mileage: <40 (light blue), 40-60 (medium blue), 60-80 (dark blue), >80 (darkest blue)
- Session Emphasis: None (light blue), Threshold (medium blue), Race Pace (dark blue)
- Strength and Conditioning Priority: Low (yellow), Medium (orange), High (red)
- Testing: Strength (purple), Physiol. (dark purple), Biomech. (grey)



Principles of programme design

Workout design

- Training phase will determine individual workouts
- Consider context of training week
- Vary exercise selection, sets and repetitions and emphasis within each week



Workout design: Exercise order and selection

■ Order

- High skill, high speed, high power movements
- Lower body strength exercises
- Lower body assistance exercises
- Upper body exercises
- Abdominals

■ Selection

- Physical properties
 - Power
 - Strength
 - Hypertrophy
- Movement patterns
 - Pull and press
 - Upper and lower
 - Balance



Principles of programme design

Workout design: Exercise selection

- Hamstring exercises
 - Glute ham raise
 - RDL
 - Deadlift
 - SB Hamstring Curls
 - Russian Curls
 - Hamstring Curls
 - Reverse hyperextensions
 - Pull throughs





Workout design: Exercise selection

- Upper body pulling exercises
 - Bent over rows
 - Chin ups
 - Pull ups
 - Bench pull
 - T-bar rows
 - Seated rows
 - DB rows
 - Cable pull
 - Inverted row
 - Seated cable pull
- Upper body pressing exercises
 - Bench
 - Incline bench
 - Decline bench
 - Close grip bench
 - DB bench
 - DB incline
 - DB decline
 - Military press
 - Dips
 - Press ups



Workout design: General template

- General template
 - Olympic lifts/power exercises
 - Squats (lower body press)
 - Hamstring exercises (lower body pull)
 - Upper body press
 - Upper body pull
 - Abdominals/trunk

Example Workout

Hang Clean	4x3
Back Squat	5x5
Glute Ham Raise	4x8
Bench	4x5
Chin Ups	4x8
Hyperextensions	3x12
Ab Circuit	



Injury prevention

Water

- Part of needs analysis of athlete
- Understand the demands of the sport
 - Must be strong enough to train
 - Balance
- Key areas
 - Muscular endurance of low back
 - Rotation/abs
 - Strength in range
 - Upper body pressing

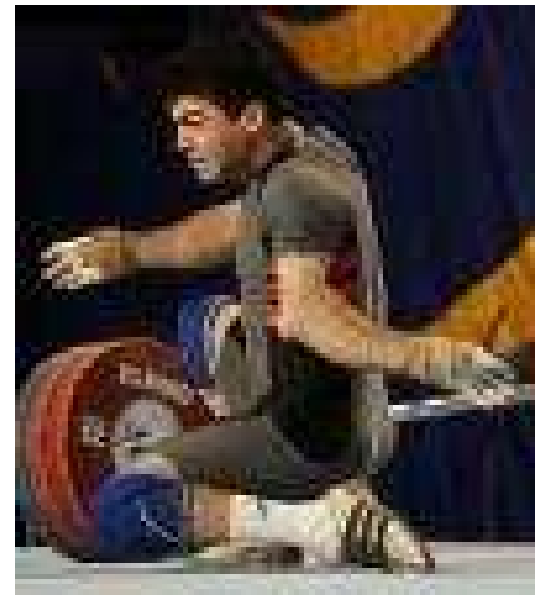




Injury prevention

Weight room

- Technique
- Appreciation of training outside weight room
- Programme considerations
 - Fatigue
 - Exercise order
- Equipment
- Attention





Injury prevention

Overtraining

- Consideration of all training variables
- How do you quantify and compare volumes and intensities?
 - Metabolic
 - CNS
- Weight room can provide variety





Summary

- Must critically evaluate
 - Sport
 - Athlete
 - Training methods
- Many tools available
- Must understand any tool employed
- Challenges involved in integrating modalities and rowing training
- Skill in coaching





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