Testing, Tracking, and Programming

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Understanding the demands (general)

Things to consider

1. Contraction type
2. Contraction velocity / intensity
3. Movement range of motion
4. **Repetition number / duration**
5. Surface used (stable, unstable etc.)
6. External load type
7. Force direction (steepness of terrain)
8. Primary movement patterns used

Work : Rest x Repetitions = energy system use. Matching the task trains the appropriate system

1. **Quasi-isometric contractions**
2. **Rapid contractions of variable timeframes and intensities**
3. **Moderate to long muscle lengths**
4. ***Rep # variable to the problem***
5. **Stable surfaces (unless feet cut)**
6. **Load at the waist, if any**
7. **Variable force vectors (climb dependent)**
8. **Upper body pulling (horizontal, vertical)**

- **Finger flexors (varies with grip)**
- **Hip, knee, and ankle extensors (concentric)**

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Isometric Strength and Its Relationship to Dynamic Performance: A Systematic Review- Journal of Exercise Science and Physiotherapy 2010

Methods: A systematic review was conducted to identify the published studies that correlated the Isometric and dynamic variables. Studies were searched using electronic databases and the methodological quality of each study was assessed using the modified Downs and Black 13 point criteria.
Results: Fifteen studies met the inclusion criteria. Marked difference in the methodology and variables used for isometric and dynamic activities were observed. Most studies correlated isometric strength assessments to dynamic activities or dynamic strength measurements.
Discussion & Conclusion: Although there are conflicting opinions regarding the use of isometric measurements, most studies in our review report moderate to strong correlation between Isometric strength and dynamic performances specially those which involve large amounts of force and explosive power.

Keywords: Isometric, dynamic, strength, power, performance, methodological quality

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Testing order

1. Adequate warm-up
2. *Maximum Strength*
3. *RFD/Power/contact*
4. Anaerobic capacity
5. Endurance

-Maximum Strength
-RFD, Contact str.
-High-int. Capacity

Gstrength500 by
@exsurgo.us

No hang block by
@tensionclimbing

-Power output
-Low-int. capacity
Powertool by
@gymaware
@vitruvefit

-Muscular endurance
-Repeater capacity
Hangboard by
@tensionclimbing

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Testing method → Training method

Testing method	Training method	
Isotonic rep-maximum 1rm, 5rm (Full ROM)	Body weight independent Peak load * (.% target) Avg peak (2 angles) *(.75-.85) *(.%target)	Isotonic
	Body weight dependent Peak load – BW * (.% target) Avg (2 angles) - BW *(.75-.85) *(.%target)	
Isometric maximum MVIC (Angle specific)	Body weight independent Peak load * (.15) * (.%target) Peak load *(.%target)	Isometric
	Body weight dependent Peak load * (.15) - BW * (.%target) Peak load - BW * (.%target)	

Weights, dumbbells, kettlebells
Bands
Chains
Hangboard

Gstrength500
Crane scale
GymAware
Tindeq progressor
Entralpi
Lattice digital

The method you use depends on many things

- **Cost**
- **Time**
- **Accuracy (both are good)**
- **Understanding ***
- **Athlete interest and motivation (buy-in)**

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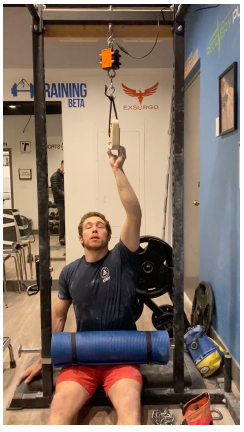
Isometric testing for climbers – *Max strength*

Hip extension / core

Vertical/horizontal pull



Finger specific strength

Horizontal press

- Peak force measurement – 2 joint angles measured (except fingers)
- Slow speed strength for up to 3-5 seconds (1.5s. Average)
- Measure of effort

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Isometric testing for climbers – *RFD (power)*

Vertical/horizontal pull

Hip extension / core

Finger specific strength

- Force measured as rapidly as possible – optimal joint angle usually
- High-velocity strength for up to 1 second (100ms Average)
- Measure of intent (effort)

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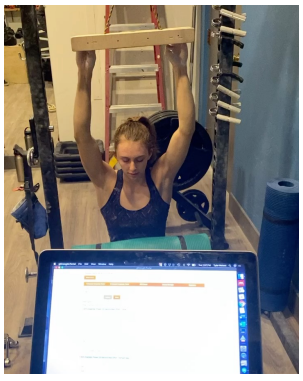
Isometric testing for climbers – *Capacity*



Power capacity

Anaerobic / continuous

Repeat effort capacity

- Force over a specified time period (variable) – optimal joint angle only
- High-velocity repeats, or fixed work:rest ratio used
- Measure of capacity (max effort)

*could do this for other movements other than fingers

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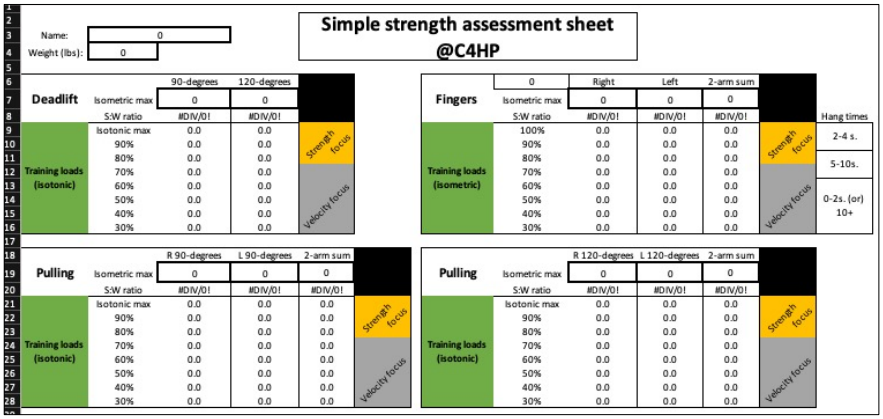
Using the load calculator and tracking sheet



Name: 0
Weight (lbs): 0

Simple strength assessment sheet @C4HP

Deadlift	Isometric max	90-degrees	120-degrees
		0	0
	S:W ratio	#DIV/0!	#DIV/0!
Training loads (isotonic)	Isotonic max	0.0	0.0
	90%	0.0	0.0
	80%	0.0	0.0
	70%	0.0	0.0
	60%	0.0	0.0
	50%	0.0	0.0
	40%	0.0	0.0
	30%	0.0	0.0

Strength focus / Velocity focus

Fingers		0	Right	Left	2-arm sum
	Isometric max		0	0	0
	S:W ratio		#DIV/0!	#DIV/0!	#DIV/0!
Training loads (isometric)	100%		0.0	0.0	0.0
	90%		0.0	0.0	0.0
	80%		0.0	0.0	0.0
	70%		0.0	0.0	0.0
	60%		0.0	0.0	0.0
	50%		0.0	0.0	0.0
	40%		0.0	0.0	0.0
	30%		0.0	0.0	0.0

Strength focus / Velocity focus

Hang times: 2-4 s. / 5-10s. / 0-2s. (or) 10+

Pulling	Isometric max	R 90-degrees	L 90-degrees	2-arm sum
		0	0	0
	S:W ratio	#DIV/0!	#DIV/0!	#DIV/0!
Training loads (isotonic)	Isotonic max	0.0	0.0	0.0
	90%	0.0	0.0	0.0
	80%	0.0	0.0	0.0
	70%	0.0	0.0	0.0
	60%	0.0	0.0	0.0
	50%	0.0	0.0	0.0
	40%	0.0	0.0	0.0
	30%	0.0	0.0	0.0

Strength focus / Velocity focus

Pulling	Isometric max	R 120-degrees	L 120-degrees	2-arm sum
		0	0	0
	S:W ratio	#DIV/0!	#DIV/0!	#DIV/0!
Training loads (isotonic)	Isotonic max	0.0	0.0	0.0
	90%	0.0	0.0	0.0
	80%	0.0	0.0	0.0
	70%	0.0	0.0	0.0
	60%	0.0	0.0	0.0
	50%	0.0	0.0	0.0
	40%	0.0	0.0	0.0
	30%	0.0	0.0	0.0

Strength focus / Velocity focus

- https://drive.google.com/open?id=1J4WUd2ebA2RGhp925lhsKKgaPsdF1nAq

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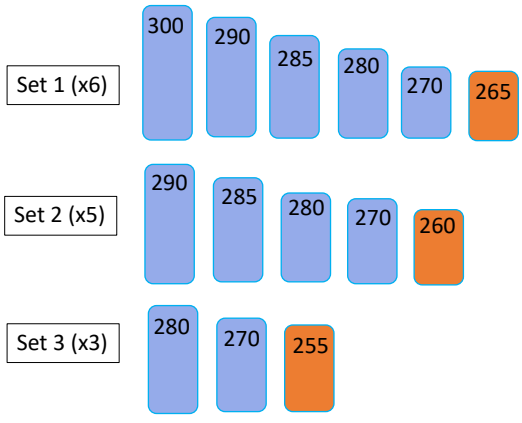
APRE (autoregulatory progressive resistance exercise)

- **Athletes that measure *peak force* every rep**
  - ✓ improve force output
  - ✓ Perform better on follow-up tests
  - ✓ Perform less overall training volume
  - ✓ Have less incidence of injury due to manipulating training more frequently
- **Example: Peak force focus training**
  - ✓ Peak force: 305 lbs
  - ✓ 90% force cut-off
  - ✓ Continue each set until they fall below 270 lbs



Instead of 3 x 6 reps (fixed) = 18 they did 15 reps at peak intensity

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Why does periodization work?

- Adds variation to training
- Manipulation of:
  - sets
  - repetitions per set
  - exercise order
  - number of exercises
  - resistance used
  - rest periods
  - type of contraction
  - training frequency
- Avoids of training plateaus and boredom

Table 1. *General Training Guidelines*[102]

Goal	*Rep Range*	*Volume*	*Rest Period*
Power	1-5	Low	Longer
Strength	2-8	Mod	Moderate
Hypertrophy	8-15+	Mod-High	Short-Moderate
Endurance	>15-20	High	Shorter

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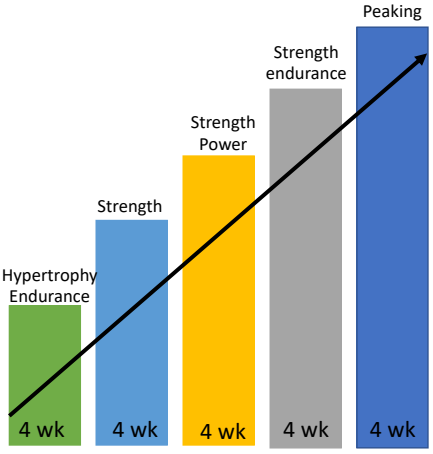
Periodization overview

- The planned manipulation of training variables within a certain period, in order to maximize training adaptations, and to prevent the onset of overtraining syndrome.
- Rehabilitation is modified periodization
- Not much research on periodization and adolescent athletes



Linear model

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A Systematic Review of Meta-Analyses Comparing Periodized and Non-periodized Exercise Programs: Why We Should Go Back to Original Research. –Frontiers in Physiology 2019

"Overall, our research has shown that meta-analyses on exercise periodization ***do not demonstrate that periodized programs are superior to non-periodized, varied programs***. There is also no reliable evidence in these meta-analyses that periodized programs could be used to predict or manage timings of adaptations."

Periodization implies variation,
variation does not imply periodization.

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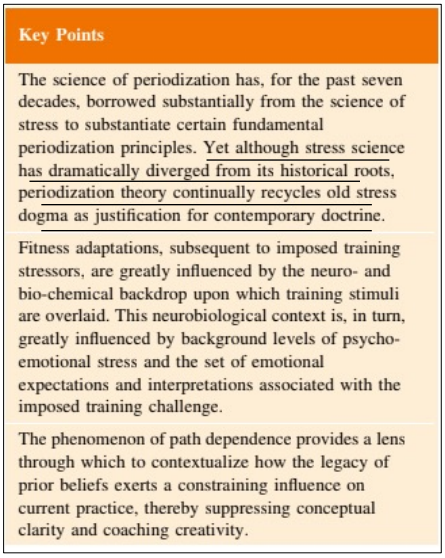
Periodization Theory: Confronting an Inconvenient Truth.

Sports Medicine Journal 2018

"*something that seems normal today began with a choice that made sense at a particular time in the past, and survived despite the eclipse of the justification for that choice*." -John McWorther

- Selye never considered the application of his research to sporting domains
- **Stress is not a predictable biologically mediated phenomenon**
  - Non physical factors cause physiologic stress
  - Stress response not generalized and non-specific, but *highly individualized and context specific*



Key Points

The science of periodization has, for the past seven decades, borrowed substantially from the science of stress to substantiate certain fundamental periodization principles. Yet although stress science has dramatically diverged from its historical roots, periodization theory continually recycles old stress dogma as justification for contemporary doctrine.

Fitness adaptations, subsequent to imposed training stressors, are greatly influenced by the neuro- and bio-chemical backdrop upon which training stimuli are overlaid. This neurobiological context is, in turn, greatly influenced by background levels of psycho-emotional stress and the set of emotional expectations and interpretations associated with the imposed training challenge.

The phenomenon of path dependence provides a lens through which to contextualize how the legacy of prior beliefs exerts a constraining influence on current practice, thereby suppressing conceptual clarity and coaching creativity.

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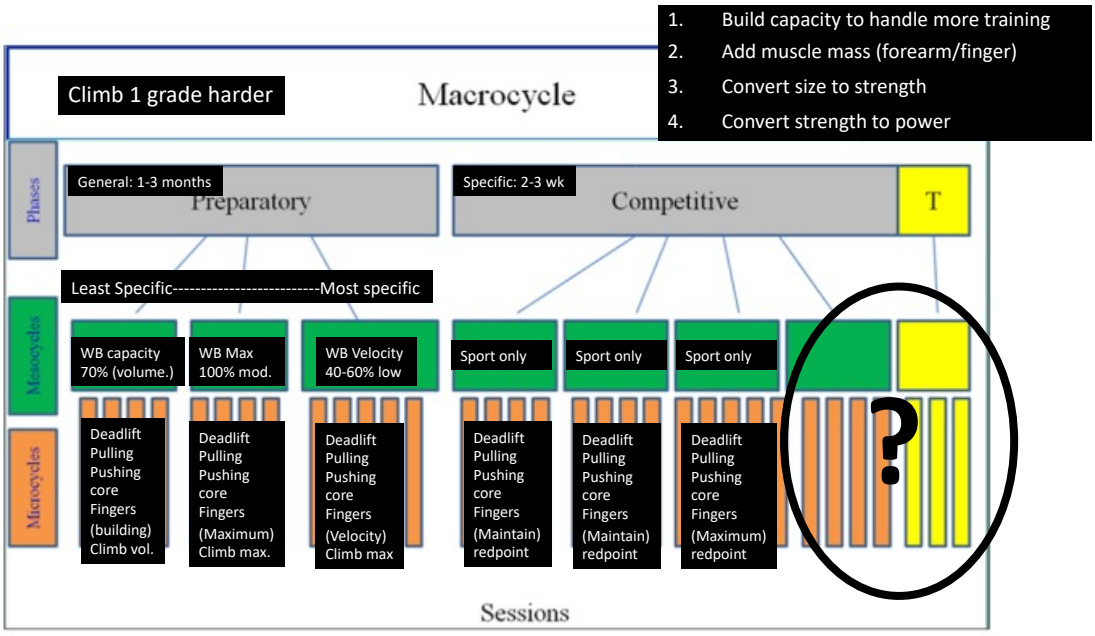

Figure 1. *Basic component of training plan. T: transition period.*

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Exercise selection

1. Goal of the sport
2. Proper energy system
3. Sports specific?
4. Muscles involved
5. Injury status
6. Movement plane
7. Anthropometrics
8. Exercise progression
   - ✓ Experienced vs. novice
9. Mobility / flexibility
10. Need for variation
11. Ideal vs. realistic

Absolute strength	
Deadlift (rack pull)	80-100 % 1rm
Weighted pull-up / overcoming isometric	80-100 % 1rm
Bench press	80-100 % 1rm
Finger pull overcoming isometric	80-100 % 1rm
Strength-speed	
Velocity focused Deadlift (ground)	60-80% 1rm
Velocity focused pull-up (120-degrees)	60-80% 1rm
Bench press repeaters	60-80% 1rm
Finger repeaters	60-80% 1rm
Speed-strength	
Single-leg deadlift (concentric)	40-60% 1rm
Concentric only pull-up	40-60% 1rm
Inverted box compression repeater	40-60% 1rm
Velocity focused finger hangs	40-60% 1rm
Explosive	
Single-leg jumps	BW
Single-arm jump and stick	BW
Concentric ballistic push-up	BW
Concentric campus move	BW
Speed	
Banded jumps	-BW
2-arm ballistic iso pulls (RFD)	-BW
2-arm ballistic iso bench	-BW
2-arm ballistic finger pulls for rep	-BW

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General → Specific

Overview

• Muscle action	Yielding Iso / heavy eccentric	Overcoming iso / Isotonic	Quasi-Isometric / concentric
• ROM	Partial / static	Full /partial	Partial/full
• Movement speed / velocity	Slow (yielding)	Moderate	Rapid
• Muscle group	Isolated (single joint)	Multi-joint 2-limb (bilateral)	Movement patterns Single-limb (unilateral)
• Energy system	General	Mixed	Focused
• Intensity & volume	Moderate / higher	High / moderate	Variable / low

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General → Specific

Exercise examples

	3-4 days / week	**2-3 days / week**	**1-2 days / week**
• Deadlift / hip extension	**60-80% full rom 3-5 x 10 Hamstring curl 3 x 10**	**Mid-thigh over. Iso 5 x 3-5s. 90-deg over. Iso 5 x 3-5s.**	**Floor concentric pull at 40-60% 5 x 3 clustered, for velocity**
• Vertical pulling	**Yielding iso 4 x 30s. 60-80% full ROM 3 x 8-10 Eccentric overload 3 x 6**	**1-arm over. iso 6 x 3-5s. Concentric pulls (max) 3 x 5 Rapid eccentric drops 3 x 3**	**Bar velocity hangs / jumps 5 x 3 Concentric velocity @70% 5 x 1 2-arm bar hops 5 x 3 90-120**
• Horizontal pressing	**Bench repeaters 5:3x5 @ 85% Bench press full ROM 3 x 10 Squeeze press 3 x 10**	**Pin push 6 x 3-5s. 90-120 tension press 3 x 5 1-arm lock off at 90-d. 5 x 5s.**	**Ballistic pin push 5 x 3 Concentric 50-70% bench 5 x 2 Ballistic push-up 5 x 3**
• Core specific	**Knees to elbow 3-5 x 10 1/3 levers 4 sets to failure**	**Spinal flexion over. Iso 4 x 3-5s. Reverse dragon flies 3 x 5**	**Velocity levers 5 x 3 @ 1-3s. Jump and stick iso 5 x 3 /arm**
• Finger training	**Density hangs 5 x 30-seconds 10s. Weighted hangs 2-3 finger positions**	**Recruitment pulls 3 x 3-5s. Strength repeaters at 90% (2-3 finger positions)**	**Velocity pulls 5 x 3 @3s. Velocity repeaters at 60% (2-3 finger positions)**
• Climbing	**75% boulder repeats 75% route repeats**	**Limit bouldering (moves) Boulder problems on the clock**	**Redpoint bouldering (moves) Redpoint climbing (tactics)**

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Suggestions for youth athletes

- 5-6 year old participants
- 8-20 week blocks (2-3 school years)
- Progressive multi-set exercise
- **Machine, free weights, hydraulic machines, medicine balls, isometrics, elastic bands, and body weight exercise**
- Follow principles of ***specificity***
- Strength gains of 30-74% reported in 8-20 weeks
  - Pre-adolescents similar, if not greater gains than adolescents
- **No major difference in strength development between boys and girls**

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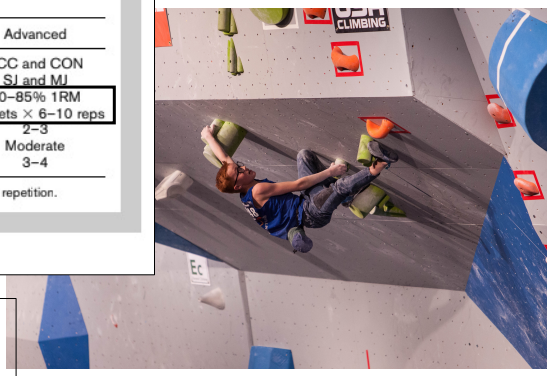
Youth strength training applications

Table 2. Recommendations for progression during resistance training for strength.*

	Novice	Intermediate	Advanced
Muscle action Exercise choice	ECC and CON SJ and MJ	ECC and CON SJ and MJ	ECC and CON SJ and MJ
Intensity	50–70% 1RM	60–80% 1RM	70–85% 1RM
Volume	1–2 sets × 10–15 reps	2–3 sets × 8–12 reps	≥3 sets × 6–10 reps
Rest intervals (min)	1	1–2	2–3
Velocity	Moderate	Moderate	Moderate
Frequency (d·wk^{-1})	2–3	2–3	3–4

*ECC = eccentric; CON = concentric; SJ = single joint; MJ = multi-joint; 1RM = 1 repetition maximum; rep = repetition.

S72 the Journal of Strength and Conditioning Research™



Novice: no or limited resistance training experience
Intermediate: 3-12 months consistent experience
Advanced: at least 12 months experience

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Youth power training applications

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Table 3. Recommendations for progression during resistance training for power.*

	Novice	Intermediate	Advanced
Muscle action	ECC and CON	ECC and CON	ECC and CON
Exercise choice	MJ	MJ	MJ
Intensity	30–60% 1RM VEL	30–60% 1RM VEL 60–70% 1RM STR	30–60% 1RM VEL 70 to ≥80% 1RM STR
Volume	1–2 sets × 3–6 reps	2–3 sets × 3–6 reps	≥3 sets × 1–6 reps
Rest intervals (min)	1	1–2	2–3
Velocity	Moderate/fast	Fast	Fast
Frequency (d·wk^{-1})	2	2–3	2–3

*ECC = eccentric; CON = concentric; MJ = multi-joint; 1RM = 1 repetition maximum; VEL = velocity; STR = strength; rep = repetition.

Novice: no or limited resistance training experience
Intermediate: 3-12 months consistent experience
Advanced: at least 12 months experience

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Strength training session variables to consider

- **Warm up and cool down**
  - ✓ Dynamic and static stretching / reflection
- **Choice and order of exercise**
  - ✓ Promote balance across joints (opposition)
  - ✓ Larger (multi-joint) to smaller (single-joint) exercises
- **Training intensity**
  - ✓ Light loads, more reps to start with
  - ✓ **1,2 sets of 10-15 reps**, then **3-5 sets of 6-8 reps**
  - ✓ Can use prediction equations and child-specific perceived exertion
- **Rest intervals between reps, sets, and exercises**
  - ✓ 1-3 minutes for primary, multi-joint exercise
- **Rep velocity**
  - ✓ Depends on exercise and strength goals
- **Training frequency**
  - ✓ 2-3 x / week (non-consecutive days)
  - ✓ 1-2x / week for maintenance
- **Program variation**
  - ✓ Important long-term
  - ✓ Added stimulus, reduce boredom

Specificity (SAID)

1. Contraction mode
2. Velocity
3. Joint angle at peak contraction (or) ROM
4. Repetition # (*metabolic*)
5. Degree of stability
6. External load type
7. Force vector
8. Muscle group used

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	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 1	**Strength cap.**		**Strength cap.**		**Max Str.**	**Strength cap.**	
Week 2	Max Str.		Strength cap.			Max str.	
Week 3	Velocity focus		Max str.		Max Str.	Velocity focus	
Week 4	Velocity focus		Velocity focus			Rest	Rest
	Week 5 climb project						

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- Strength capacity (4-6 sessions) *2-min between sets*
  - ✓Deadlift @75% 5 x 10 reps from mid-thigh
  - ✓Bench press iso @ 75% 5:3x5s. (x6) 2-angles, 3 sets form each
  - ✓Vertical pull iso @ 75% 6 x 30s. (x6) 2-angles. 2-arm, 3 sets from each
  - ✓Finger density hangs @75% 5 x 20-30s. (x3) per position. 2 total
- Maximum strength (3-5 sessions) *3-min between sets*
  - ✓Deadlift @100% 6 x 3-5s. 3 from mid-thigh, 3 from 90-degrees
  - ✓Bench pin push @ 100% 6 x 3-5s. (x6 total), 3 from each angle
  - ✓Vertical pull iso @ 100% 6 x 3-5s. (x6 total). 1 or 2-arm, 3 from each angle
  - ✓Recruitment pulls @100% 6 x 3-5s. (x3 total) 2 finger positions (LML)
- Velocity focus (4-6 sessions) clustered reps (5-10s. between reps, 2 min between sets)
  - ✓Deadlift for velocity @40-60% 5 x 3 from floor (concentric velocity focus)
  - ✓Bench press @ 40-60% 5 x 3 from 90-degrees (concentric velocity focus)
  - ✓Rapid bar hangs 40-60% 5 x 3 from LML (velocity focus)
  - ✓Velocity hangs @ 40-60% 3:3x5 (x4 total) 2 positions max (LML)

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Thank you

Link to my course schedule:

https://www.camp4humanperformance.com/store

Link to my private consult schedule:

https://www.camp4humanperformance.com/remote-consultation

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