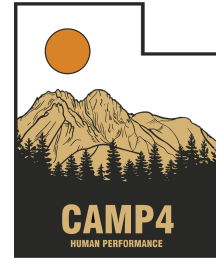


Strength Training & Mobility Basics For Climbers



Tyler Nelson DC, MS, CSCS
Camp4 Human Performance
@C4HP

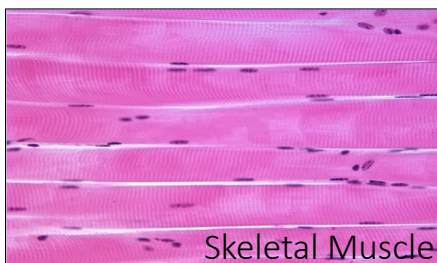


PERFORMANCE
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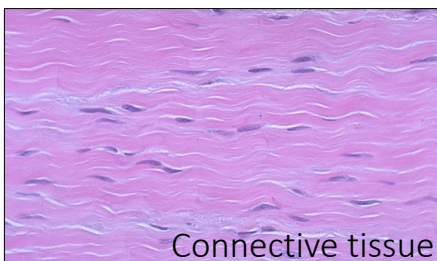


1

Tissue response to loading



- 95% cellular material
- Stabilize joints through **force closure** (training)
- Large blood and nerve supply
- **Respond quickly to training (days to weeks)**
- Flexible (mechanical / metabolic)
- Energy storage = better capacity for training



- 95% non-cellular (Tendons / ligaments / bones)
- Stabilize joint through **form closure** (genetics)
- Aligned collagen and water
- Small blood and nerve supply
- **Respond slowly to training (months to years)**
- Inflexible (mechanical / metabolic)

2

Strength through coordination

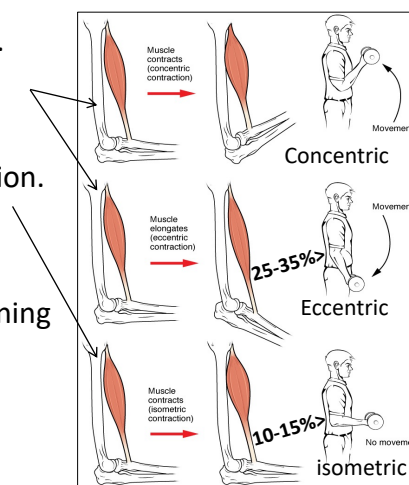
- All movements are the result of many muscle working at once.
- Most muscles are arranged in agonist-antagonist pairs
 - ✓ **prime mover (or) agonist** contracts to cause the desired action
 - ✓ **antagonist** stretches and yields to prime mover - *relaxes*
 - ✓ **synergists** contract to stabilize nearby joints
 - ✓ **fixators** stabilize the origin of the prime mover
 - scapula held steady so deltoid can raise arm (quasi-isometric at the rotator cuff)



3

Different types of muscle work

- Isotonic
 - ✓ Change in length with constant tension.
 - ✓ Ex: *pull-ups, push-ups*
- Isometric
 - ✓ No change in length but change in tension.
 - ✓ Ex: *lock-offs, fingerboarding*
- Quasi-isometric
 - ✓ Shortening and one joint while lengthening at another.
- Isokinetic
 - ✓ Constant tension through a full range (need specific equipment)

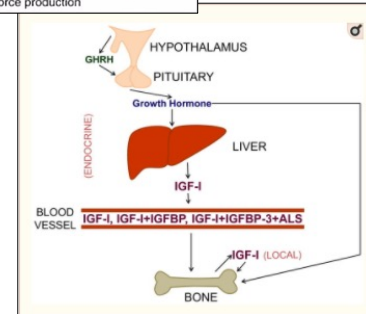
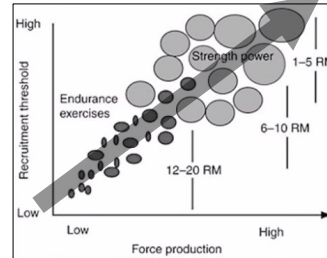


All have their own maximums!

4

Progressive overload

- **Heavy loads increase**
 - ✓ Coordination
 - ✓ type II motor unit recruitment
 - ✓ number of muscle fibers engaged within a muscle
- **Heavy loads** elevate anabolic hormones
 - ✓ testosterone
 - ✓ growth hormone
 - ✓ insulin-like growth factor (IGF-1)
- Increase production of IGF-1.
 - ✓ related to brain-derived neurotrophic factor (**BDNF**)
 - ✓ neurotransmitter responsible for stimulating neural pathways in the brain
 - ✓ **heavy lifting could make you smarter by enhancing cognitive function (kids)**
- **Heavy loads can** improve self-confidence
 - ✓ knowing athletes can lift heavy provides confidence for sport. Builds resilience to sporting loads



- GH helps increase muscle mass and decrease body fat.
- GH helps with metabolism (catabolic + anabolic)

5

The effects of resistance training, overtraining, and early specialization on youth athlete injury and development: Systematic Review 2018

- Appropriately-designed resistance training programs
 - ✓ reduce muscle imbalances
 - ✓ keep athletes healthy
 - ✓ allow long-term involvement in competition
- Not an additional training session
 - ✓ alternative commitment *in place of* sport-specific training or competition
- Programs implemented in primary schools improve
 - ✓ aerobic capacity
 - ✓ strength
 - ✓ acquisition of fundamental movement skills
- Potential gender specific window for optimal implementation. Pre-pubertal girls are particularly sensitive to resistance training.



6

Position statement on youth resistance training: The 2014 International Consensus

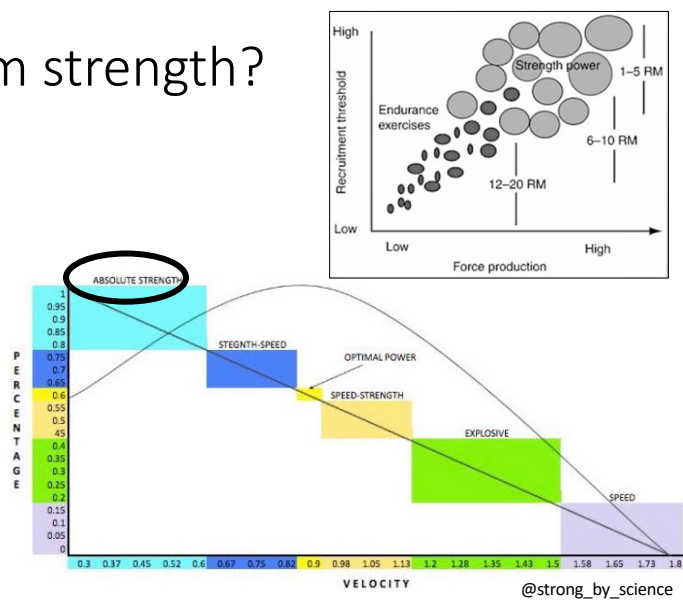
- Many benefits associated with adult resistance training programs are attainable by children and adolescents
- 4 major areas of importance
 1. Risks and concerns
 2. Health and fitness benefits
 3. Types and amount of resistance needed
 4. Program design considerations

“To date, injury to the growth cartilage has not been reported in any prospective youth resistance training research study. Furthermore, there is no evidence to suggest that resistance training will negatively impact growth and maturation.”

7

What is maximum strength?

- The *peak force* an athlete can reach with a movement
- Max strength is a function of *recruitment*
- Maximum strength movements are *slow*
- Measure of *effort*



8

How to train strength (relative to ones mass)



123 lb female
545 lb max
4.43 s:w ratio

How:

- ✓ Over 80-100% 1rm
- ✓ Focus on *movement patterns (full ROM for mobility)*
- ✓ 3-20 sets
- ✓ 1-5 reps per set (**3x10 vs. 10x3**) more 1st reps in latter
- ✓ **Focus on force production (low velocity)**
- ✓ recovers in **30-60 seconds** but up to 3 minutes is optimal
- ✓ 2-3 times per week is typical

Primary Movement Patterns

Upper body
Horizontal. Pulling
Vertical. Pulling
Horizontal. Pressing
Vertical. pressing

Legs
squat/press
Hinge/pull
Lunge/single leg

Core
Flexion - spinal
Ext./anti-rotation
Rot./anti-rotation

9

How to train *recruitment* in the fingers (low velocity)



Yielding isometric
60-75% MVC

Workout	Beginner	Expert
Workout 2: Density hangs		
Frequency	2 x / week 4-6 hours after climbing. Done after recruitment pulls	1 x / week 4-6 hours after climbing. On a day by itself
Grip positions	Two positions of 2-arm hangs: Easy slope - open hand 25-25 mm half crimp	Three positions of 2-arm hangs: Hard slope - open hand 15-10mm half crimp 10mm full crimp
Sets	1	1-2
Repetitions	2	3
Time under tension	20-40 seconds, or failure	
Velocity of movement	Slow	
Intensity	Moderate to low	
Focus	Slow static loading to muscular failure	
Rest between efforts	3-5 minutes	
Cycle time	4-5 weeks	4-5 weeks

10

How to train peak force in the fingers (moderate velocity)



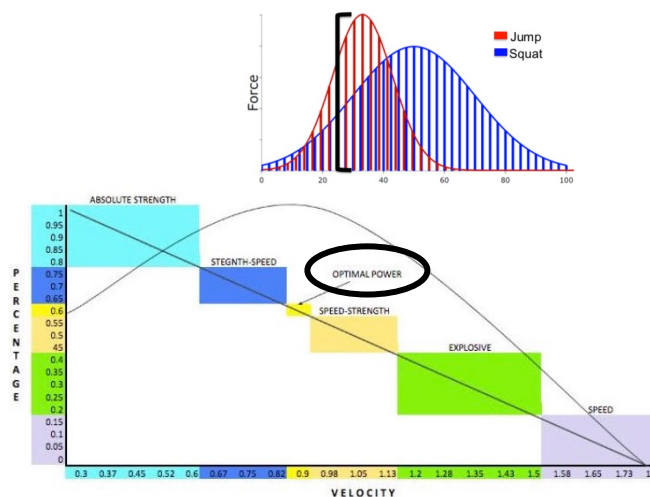
Overcoming isometric 80-100% MVC

Workout	Beginner	Expert
Workout 1: Recruitment pulls		
Frequency	2 x / week 4-6 hours after climbing.	2 x / week 4-6 hours after climbing
Grip positions	Two positions of 1-arm pulls: 20mm open hand 20mm half crimp	Two positions of 1-arm pulls (or) hangs: 20-15mm open hand 15-10mm half crimp
Sets	1	1-2
Repetitions	3	4-5
Time under tension	3-5 seconds	
Velocity of movement	Slow	
Intensity	Maximum	
Focus	Force focus (try hard)	
Rest between efforts	60-120 seconds	
Cycle time	4-5 weeks	4-5 weeks

11

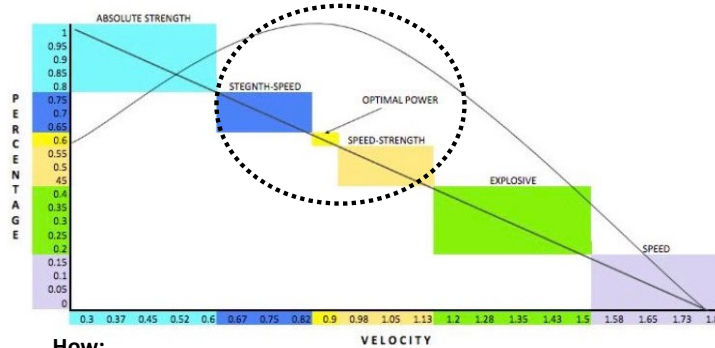
Is strength the same as power?

- Power is the peak force an athlete can reach in *specified time period*
- "power" movements are *rapid* as possible
- *Focus on speed, not force*
- *Instead of power we can use high-speed strength*



12

How to train power



5 principles to follow

1. Maximal intent
2. Highest readiness
3. Optimal load
4. Prioritize velocity
5. Minimize fatigue

How:

- ✓ Over 40-80% 1rm
- ✓ Focus on *movement patterns*, not muscle groups
- ✓ 3-5 sets
- ✓ 1-5 reps per set (3x5 vs. 5x3) more 1st reps in latter
- ✓ **Focus on velocity**
- ✓ Cluster reps?, rest between sets is variable?
- ✓ 2-3 sessions per week is typical **after strength phase**

Physiologically what's happening?

- Incr. Ca⁺ sensitivity
- Incr. rate coding (speed of nerve impulse)
- Incr. central drive (CNS)
- Fiber type transitions IIa-IIx

13

How to train contact strength in the fingers (highest velocity)



Rapid isometrics (velocity)
65-85% MVC

Workouts	Beginner	Expert
Workout 3: Speed pulls		
Frequency	Only performed after cycle of recruitment and density hangs. 2 x / week	2 x / week 4-6 hours after climbing. Done after recruitment pulls
Grip positions	Two positions of 2-arm hangs: Easy slope – open hand 35mm pocket	Two positions of 1-arm pulls (or) hangs: 20mm open hand 20-15mm half crimp
Sets	1	1-2
Repetitions	2-4	5-8 (or) until power drops
Time under tension	1-3 seconds	
Velocity of movement	Fastest	
Intensity	Moderate to high	
Focus	Speed focus	
Rest between efforts	10-20 seconds	
Cycle time	4-5 weeks	4-5 weeks

14

Training age matters for power training

- For the novice, focused strength development alone is often sufficient for power development, without the addition of any specific work
- Stronger individuals respond better to the addition of specific velocity-based exercises than weaker ones
- Maximal strength levels constrain the upper limits of maximal power output. The ability to generate force rapidly is of little use if the level of force generated is below a necessary threshold
 - ✓ strength levels form the foundation of maximal neuromuscular power development
- Stronger individuals display greater power production initially, and also trend towards a greater effect size when compared to weaker groups.
- Maintain strength throughout a velocity-specific training phase

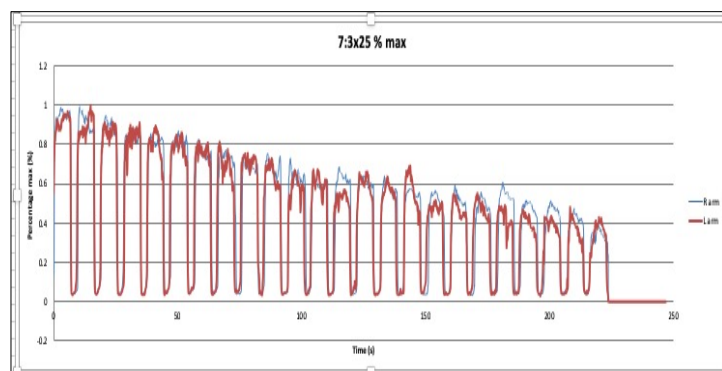


Strength before speed!

15

How does strength influence capacity (endurance)

- Capacity is the ability to produce a % of force over *multiple repetitions*
- Getting stronger makes everything a little easier.
 - ✓ Same car, bigger gas tank!
- **Strength endurance**
 - ✓ Higher intensity
 - ✓ Lower velocity
 - ✓ More repetitions
 - end with effort failure
- **Power endurance**
 - ✓ Lower intensity
 - ✓ Higher velocity
 - ✓ Fewer repetitions
 - End with power loss



16

Power endurance

- Multi-joint movements
- 5 sets, 30-60% intensity
- 5-10 reps (or) 12-20 s.
- 60-120 seconds rest
- *Mod to high velocity / low tempo*
- Full ROM (**mobility**)

Pull-ups for vel.
Hip ext. for vel.
Pushing for vel.
Campus board distance
Velocity hangs
Jump and catch

Muscular endurance

- Single or, multi-joint movements
- 3-5 sets, 50-80% intensity
- 10-25 reps (or) 30-45 s.
- 30-120 seconds rest
- *High to mod. Velocity / high tempo*
- Full ROM (**mobility**)

• Pull-ups for reps
• Hip ext. for reps
• Pushing to *failure*
• Continuous hangs
• Partial lever (1/4, 1/3, 1/2)
• LML lock-offs to *failure*

17

High-Int. endurance

Anaerobic (fatigue focus, not power)

- Complex movements
- 3-12 sets (no reps per-se)
- Work:Rest = **3:1 – 1:5**
✓ 10, 30, 60, 120-second etc. work
- ***As work goes up, quality goes down (survival fatigue)***
- ***As work goes down, quality goes up (performance)***
- **2-3 min bouts before break**
- **>VO2 max (higher intensity)**

Aerobic

- Anything you can do maximally for time
- **3:1-1:2**
- **3-15 minute bouts**
- = VO2 max (*lower intensity*)

Long-dur. endurance

- **1-3 repetitions**
- **Continuous**
- **<100% VO2 max or HR**
- **>12 min activity**
- **Low intensity (conversational intensity)**
- **Low velocity – efficiency focus (distance focus)**

*HIIT is comparable to steady state training for endurance adaptations

18

Endurance training for the fingers

HIMA

- **Holding Isometric Muscle Action**
- More *eccentric like*
- More energy used
- Less endurance

PIMA

- **Pushing (or) Pulling Isometric Muscle Action**
- More *concentric like*
- Less energy use
- More endurance



Failure hangs with fixed rest, Repeaters etc.



PIMA repeaters

19

Review of today's course

- How do we get **stronger**?
 - ✓ By progressively overloading a specific movement
 - Slow and heavy through full ROM is the best strategy for mobility
- How do we become more **powerful**?
 - ✓ *By getting stronger!*
 - ✓ By training to produce more force in *a short timeframe*
 - Fast and rapid through a full ROM will improve sports performance
- How do we gain better **endurance**?
 - ✓ *By getting stronger!*
 - ✓ By creating *work:rest ratios* that are specific to a climbing task
 - Time-under-tension, rest, duration, hold type, difficulty, edge size etc.
 - Full ROM causes higher metabolic fatigue for endurance gains
- How do we prevent getting injured?
 - ✓ *By getting stronger!*
 - ✓ By staying strong through the season (in-season resistance training)
 - ✓ By having a structured training program (**next weekends course**)

20

Thank you

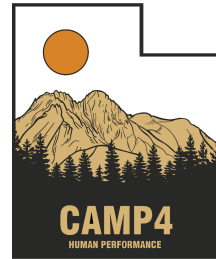
Link to my course schedule:

<https://www.camp4humanperformance.com/store>

Link to my private consult schedule:

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

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21

Updated Position Statement Paper From the NSCA

TABLE 1. General youth resistance training guidelines.

- Provide qualified instruction and supervision
- Ensure the exercise environment is safe and free of hazards
- Start each training session with a 5- to 10-minute dynamic warm-up period
- Begin with relatively light loads and always focus on the correct exercise technique
- Perform 1–3 sets of 6–15 repetitions on a variety of upper- and lower-body strength exercises
- Include specific exercises that strengthen the abdominal and lower back region
- Focus on symmetrical muscular development and appropriate muscle balance around joints
- Perform 1–3 sets of 3–6 repetitions on a variety of upper- and lower-body power exercises
- Sensibly progress the training program depending on needs, goals, and abilities
- Increase the resistance gradually (5–10%) as strength improves
- Cool-down with less intense calisthenics and static stretching
- Listen to individual needs and concerns throughout each session
- Begin resistance training 2–3 times per week on nonconsecutive days
- Use individualized workout logs to monitor progress
- Keep the program fresh and challenging by systematically varying the training program
- Optimize performance and recovery with healthy nutrition, proper hydration, and adequate sleep
- Support and encouragement from instructors and parents will help maintain interest

22

If you don't want to use 1RM testing

- Use 5rm, 10 rm, or isometrics
- Google search NSCA training load chart

Max reps (RM) % 1RM	TRAINING LOAD CHART											
	1	2	3	4	5	6	7	8	9	10	12	15
100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%
10	9.5	9.1	8.7	8.3	7.9	7.5	7.1	6.7	6.3	5.9	5.5	5.1
20	19	18.1	17.2	16.4	15.6	14.8	14.0	13.2	12.4	11.6	10.8	10.0
30	28.5	27.9	27	26.1	25.5	24.9	24	23.1	22.5	21	20	19
40	38	37.2	36	34.8	34	33.2	32	30.8	30	28	27	26
50	47.5	46.5	45	43.5	42.5	41.5	40	38.5	37.5	35	34	33
60	57	55.8	54	52.2	51	49.8	48	46.2	45	42	41	40
70	66.5	65.1	63	60.9	59.5	58.1	56	53.9	52.5	49	48	47
80	76	74.4	72	69.6	68	66.4	64	61.6	60	56	55	54
90	85.5	83.7	81	78.3	76.5	74.7	72	69.3	67.5	63	62	61
100	95	93	90	87	85	83	80	77	75	70	69	68
110	104.5	102.3	99	95.7	93.5	91.3	88	84.7	82.5	77	76	75
120	114	111.6	108	104.4	102	99.6	96	92.4	90	84	83	82
130	123.5	120.9	117	113.1	110.5	107.9	104	100.1	97.5	91	90	89
140	133	130.2	126	121.8	119	116.2	112	107.8	105	98	97	96
150	142.5	139.5	135	130.5	127.5	124.5	120	115.5	112.5	105	104	103
160	152	148.8	144	139.2	136	132.8	128	123.2	120	112	111	110
170	161.5	158.1	153	147.9	144.5	141.1	136	130.9	127.5	119	118	117
180	171	167.4	162	156.6	153	149.4	144	138.6	135	126	125	124
190	180.5	176.7	171	165.3	161.5	157.7	152	146.3	142.5	133	132	131
200	190	186	180	174	170	166	160	154	150	140	139	138
210	199.5	195.3	189	182.7	178.5	174.3	168	161.7	157.5	147	146	145
220	209	204.6	198	191.4	187	182.6	176	169.4	165	154	153	152
230	218.5	213.9	207	200.1	195.5	190.9	184	177.1	172.5	161	160	159
240	229	223.2	216	208.8	204	199.2	192	184.8	180	168	167	166
250	237.5	232.5	225	217.5	212.5	207.5	200	192.5	187.5	175	174	173
260	247	241.8	234	226.2	221	215.8	208	200.2	195	182	181	180
270	256.5	251.1	243	234.6	229.5	224.1	216	207.9	202.5	189	188	187
280	266	260.4	252	243.6	238	232.4	224	215.6	210	196	195	194
290	275.5	269.7	261	252.3	246.5	240.7	232	223.3	217.5	203	202	201
300	285	279	270	261	255	249	240	231	225	210	209	208
310	294.5	288.3	279	269.7	263.5	257.3	248	238.7	232.5	217	216	215
320	304	297.6	288	278.4	272	265.6	256	246.4	240	224	223	222
330	313.5	306.9	297	287.1	280.5	273.9	264	254.1	247.5	231	230	229
340	323	316.2	306	295.8	289	282.2	272	261.8	255	238	237	236
350	332.5	325.5	315	304.5	297.5	290.5	280	269.5	262.5	245	244	243
360	342	334.8	324	312.6	305	298	288	277.2	270	252	251	250
370	351.5	344.1	333	321.9	314.5	307.1	296	284.9	277.5	259	258	257
380	361	353.4	342	330.6	323	315.4	304	292.6	285	266	265	264
390	370.5	362.7	351	338.8	331.5	323.7	312	300.3	292.5	272	271	270
400	380	372	360	348	340	332	320	308	300	279	278	277
410	389.5	381.3	369	356.7	348.5	340.3	328	315.7	307.5	287	286	285
420	399	390.6	378	365.4	357	348.6	336	323.4	315	294	293	292
430	408.5	399.9	387	374.1	365.5	356.9	344	331	322.5	301	300	299
440	418	409.2	396	382.8	374	365.2	352	338.8	330	308	307	306
450	427.5	418.5	406	391.5	382.5	373.5	360	346.5	337.5	315	314	313
460	437	427.8	414	400.2	391	381.8	368	354.2	345	322	321	320
470	446.5	437.1	423	408.9	399.5	390.1	376	361.9	352.5	329	328	327
480	456	446.4	432	417.6	408	398.4	384	369.6	360	336	335	334
490	465.5	455.7	441	426.3	416.5	406.7	392	377.1	367.5	343	342	341
500	475	465	450	435	425	415	400	385	375	350	349	348

• Training load chart can be used to calculate estimated 1-repetition maximum (1RM) values from multiple repetitions completed
 • For example, if an athlete completes 8 repetitions of the squat at 160 lbs, the estimated 1RM would be 200 lbs.
 • Training load chart can also be used to assign intensity percentages for program design
 • For example, if an athlete's 1RM for the squat is 200 lbs, he/she should be able to successfully complete 10 repetitions of 150 lbs, or 75% max intensity.

Adapted from Lander, J. Maximum based on reps. NSCA J 5(3):60-61, 1984. © 2012 National Strength and Conditioning Association (NSCA)

23

Bodyweight Dynamic Warm-Up

Complete 1 round of this bodyweight circuit before your workout to prepare your body for strength training.

Quadruped Reaches x 6-10 reps each side

Quadruped Thoracic Rotations x 6-10 reps each side

Pause Hip Bridge (2 sec) x 6-10 reps

Side-Lying Hip Abduction x 6-10 reps each side

Hollow to Superman x 6-10 reps each

Prone Fly x 20 reps

BW Push-up x 6-10 reps

Mountain Climbers x 6-10 reps each

BW Lateral Lunge x 6-10 reps each side

BW Reverse Crossover Lunge x 6-10 reps each side

Jumping Jacks x 20 reps

Burpee x 6-10 reps

Core Finisher: Level 1

Complete 2 to 3 rounds as a circuit after your workout. Rest 90 seconds between rounds.

MB Russian Twist

- 30-60 sec
- Keep arms straight
- Pause briefly at center

SB Leg Transfer

- 30-60 sec
- Keep legs straight
- Do not allow back to sag

MB Toe Touch

- 30-60 sec
- Keep legs straight and pinned together
- Bring MB up as high as possible

Prone Fly

- 30-60 sec
- Hands touch above head and back
- Keep arms and legs elevated

Flutter Kicks

- 30-60 sec
- Keep legs straight, torso still
- Alternate legs with control

Front Plank

- Hold plank for 30-60 sec
- Keep legs straight, elbows under shoulders
- Do not allow back to sag

24


12

Squat Mobility Primer

Complete 1 round of this circuit before your workout to prime your hips, knees, and ankles for squatting.


Lunge Position Mobilization

- 30 sec each side
- Gently push knee out to side
- Use exhale to increase stretch




BW Lunge to Twist

- 8-8 reps each leg
- Step into lunge, then twist both ways
- Pause briefly in center position




BW Prisoner Squat

- 10 reps
- Keep torso upright
- Sink hips into full squat




Band Lateral Walk

- 10 steps one direction, then switch
- Slight bend in hips and knees
- Do not allow slack in band




Band Good-morning

- 12 reps
- Push hips back, keep back flat
- Squeeze glutes to stand up




Band Squat

- 10 reps
- Push knees out against band
- Drive through heels to stand up




DB Lateral Lunge (5-sec hold)

- 8-8 reps each leg, alternating
- Big lateral step, bend one knee deeply
- Hold for 5 full sec at bottom



DB Goblet Front Squat (5-sec hold)

- 8-8 reps
- Hold DB to chest, sink into full squat
- Hold for 5 full sec at bottom



More like this available at voltathletics.com


This training program contains only recommendations and is intended to be used for educational purposes only. Actual exercises, volumes, and intensities are undertaken at the user's sole discretion and are performed at the user's own risk. The NSCA and VOLT make no express or implied warranties regarding this content.

Rotator Cuff Injury Prevention Primer A

Complete 1 round of this circuit before your workout to prime your shoulders for strength training.


Foam Roll: Lats

- 60-120 sec each side
- Mid-ribcage up to armpit
- Pause in spots of tension




Foam Roll: T-Spine (Arms Overhead)

- 60-120 sec each side
- Length of entire ribcage
- Flex and extend spine 1-2 inches



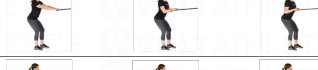
Prone Fly

- 10-20 reps each way
- Arms as straight as possible
- Isolate movement at shoulder




Band Row

- 10-20 reps
- Pause 2 sec with band at chest
- Squeeze shoulder blades together




Band Tiger Walk

- 20 reps each way
- Arms stay straight
- Isolate movement at shoulders



Band Superman Pull-Apart

- 10-20 reps
- Arms stay straight
- Isolate movement at shoulders



Band Lying External Rotation

- 10-20 reps each side
- Elbow bent at 90 degrees
- Isolate movement at shoulder





Plate Pull to External Rotation

- 10-20 reps
- Use light plates
- Squeeze shoulder blades together



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25

Upper-Body Mobility Finisher

Complete 1 round of this circuit after your workout to increase upper-body mobility and flexibility.


Foam Roll: T-Spine (Arms Overhead)

- 60-120 sec
- Roll entire length of ribcage
- Flex and extend spine 1-2 inches
- Cross arms over chest if too intense




Foam Roll: Lats

- 60-120 sec each side
- Roll mid-ribcage up to armpit
- Pause in spots of tension




Foam Roll: Pec/Shoulder

- Start with arm straight above head
- Sweep arm downward to capture tension




Band-Assisted Overhead Stretch

- 60-120 sec each side
- Anchor band above head
- Arm straight, bow head forward and down




Band-Assisted Lat Stretch

- 60-120 sec each side
- Anchor band below knees
- Move further from band to stretch lats



Band-Assisted Shoulder Internal Rotation Stretch

- 60-120 sec each side
- Anchor band below knees
- Rotate away from anchor point



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Grip Strength Finisher

Complete 1 round of this circuit after your workout to improve your hand, forearm, and grip strength.

DB Wrist Rotations

- 20 reps each way
- Isolate movement at wrist
- Keep elbows tight to body
- Use light dumbbells
- Rest 60 seconds before Plate Grippers






Plate Grippers

- 20 reps each way
- Transfer plate, gripping only with fingers
- Choose a plate that feels very heavy by the end of your set
- Rest 60 seconds before Towel Supine Row




Towel Supine Row

- 8-12 reps
- Keep body planed and still
- Use a thick towel to challenge grip
- To increase difficulty, place feet on box/bench
- Rest 60 seconds before Barbell Standing Wrist Flexion to Extension



Barbell Standing Wrist Flexion to Extension

- 8-12 reps each way
- Isolate movement at wrist
- Keep elbows straight
- Choose a weight that feels very heavy by the end of your set



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26