

NSCA

COACHES

CONFERENCE 2023

JANUARY 4 – 6, 2023

Charlotte, NC & Online | 2.0 CEUs

#NSCACoaches23

COMPLEX / CONTRAST TRAINING

(ANOTHER TOOL FOR EXPLOSIVE POWER)

*Presented by Chip Sigmon, CSCS, ISSN, RSCC*E*



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

CONFLICT OF INTEREST STATEMENT

I have no actual or potential conflict of interest in relation to this presentation.

Werner Gunthor
Best Shot Putter
in History of
Swiss Track &
Field

Three Time
World Champion
late 80s-early
90s



Objectives of Presentation

- A. Define complex training / contrast training (inconsistency in the literature)
- B. Potentiation: post-activation potentiation (PAP) (what makes Potentiation so unique)
- C. The Logistics of CT:
 - 1. Time between loaded exercise and the target exercise
 - 2. Weight (Intensity) used on the loaded exercise
 - 3. When to use CT during your macro cycle
 - 4. Volume used (sets / reps)
 - 5. Types of Movements
 - 6. Why use CT Training
 - 7. Questions??

The Key Principle of Complex / Contrast Training

“Prioritizing load and tension during the first exercise and then using a bio mechanical similar exercise with a sub-max load on the second exercise.”

(To produce a Potentiation Effect.)

“There is inconsistency in the literature”

What is Contrast Training?

What is Complex Training?

Complex =
Set for Set

Contrast =
Higher loads in the
beginning of the
workout / lighter loads
at the end of the
session.






Complex = 3 sets of half squats before 3 sets of 10 jump squats

Contrast = 1 set of half squat followed by 1 set of 10 jump squats

(set for set)

PEAK PERFORMANCE IS NOW...

SPORTS PERFORMANCE BULLETIN

FOLLOW US   

CLAIM YOUR FREE ISSUE OF SPORTS PERFORMANCE BULLETIN

WWW.SPORTSPERFORMANCEBULLETIN.COM/FREE-ISSUE/

Complex training

by Andrew Hamilton in [Strength, conditioning and flexibility](#)

Complex Training generally involves the execution of a resistance-training exercise using a heavy load (1-5RM) followed RELATIVELY QUICKLY by the execution of a biomechanically similar plyometric exercise.

(Complex = set for set)

Complex Training Revisited: A Review of its Current Status as a Viable Training Approach

David Docherty,MS,PhD,Dan Robbins,MS,CSCS and Matt Hodgson,CSCS
School of Physical Education,University of Victoria,Victoria, British Columbia

COMPLEX CONTRAST TRAINING METHODS - THE BEST TRAINING METHODS FOR SPRINTERS & SPEED POWER ATHLETES

Posted by **Cody Bidlow** on Jul 11, 2021

“Complex Training basically means that you’re using a slow and a fast exercise within the same superset or at least within the same workout.”

“For example, you can perform a back squat at a high load such as 90% of your one rep max, paired with a low load exercise such as a vertical jump or depth jump”

So Which
is it?

COMPLEX = SET FOR SET?

-OR IS-

CONTRAST = SET FOR SET?

-OR IS-

COMPLEX = 3 X 3 THEN YOUR
PLYO's (Target exercise)

-OR IS-

CONTRAST = 3 X 3 THEN YOUR
PLYO's. (Target exercise)

As you can see, the Literature is not Consistent!

For this Presentation:

Contrast will be:

- Alternating the “Potentiating” exercise (1st exercise @ around 90%)
- Followed by, after a specific amount of time, the Target / Potentiated exercise (unloaded or sub maximal load) “Set for Set”

Complex will be:

- Performing the “Potentiating” exercise, then after a specific amount of time, perform all the Potentiated exercise sets

It doesn't make any difference
what you call it,
Complex or Contrast
as long as it's
"Potentiating"

BACK SQUAT TO A VERTICAL JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

What makes
Contrast /
Complex
Training so
special or
what makes it
work?

“POTENTIATION”

“POST – ACTIVATION POTENTIATION” (PAP)

Definition:

- **DEFINITION:** PAP has been defined as an acute enhancement of muscular performance as a result of contractile history and is considered the basis of Contrast Training.

[Timothy J Suchomel¹](#), [Kimitake Sato](#), [Brad H DeWeese](#), [William P Ebben](#), [Michael H Stone](#), “Potentiation Effects of Half-Squats Performed in A Ballistic or Nonballistic Manner”

- The enhancement of Muscular force and power by use of a voluntary conditioning activity has been referred to as Post-activation Potentiation.

[Laurent B Seitz¹](#), [Eduardo S de Villarreal](#), [G Gregory Haff](#), “The temporal profile of postactivation potentiation is related to strength level”

How does (PAP) work? Several Factors:

- **The main factor: PAP occurs because a “conditioning” contraction allows for a tetanus state (sustained muscular contraction) to be reached at a lower frequency of action potential firing and the phosphorylation of regulatory light chains of myosin result in a higher Ca²⁺ sensitivity. This means your muscle takes less effort to produce more force faster (submaximal loads)! (DE. Rassier et, al, 2000)**

“It has been proposed that as an alternative mechanism (the Target Exercise) is the higher order of Motor Units.”



In other words; “the heightened excitability of the CNS.”

Time Between Exercises?

Complex Training Revisited: A Review of its Current Status as a Viable Training Approach

David Docherty, MS, PhD, Dan Robbins, MS, CSCS and Matt Hodgson, CSCS
School of Physical Education, University of Victoria, Victoria, British Columbia

Once again there is in-consistency in the literature regarding the time between the Resistance exercise and the Target Exercise:

“Complex training generally involves the execution of a Heavy load followed relatively quickly by the execution of a similar plyometric exercise. (Set for Set)”

“Recent research also suggest that 3-4 minutes of rest between Weight Training and Plyometrics may be optimal.”

JOURNAL OF SPORTS SCIENCE AND MEDICINE (JUN 2002)

COMPLEX TRAINING: A BRIEF REVIEW

William P. Ebben

Journal volume & issue

Vol. 1, no. 2

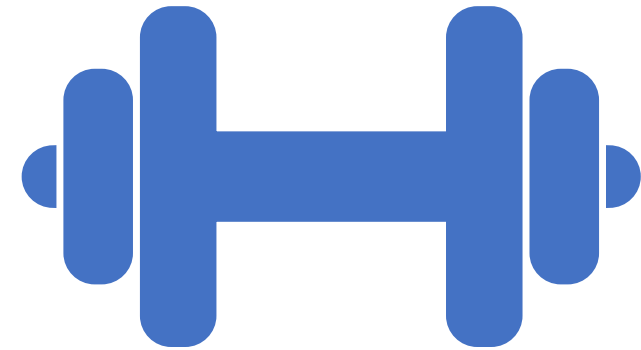


Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Dr. Michael Stone's Research

2 minutes of rest
between resistance
exercise and target
exercise



“TIME BETWEEN RESISTANT AND TARGET EXERCISE”

RELATIVELY QUICKLY: ENDURANCE

- However, if coaches prescribe a rest interval that is too short, fatigue may mask the benefits of potentiation.
- Note: The ability for Stronger athletes to Potentiate immediately after the resistance exercise may be due to their ability to resist fatigue.

3-4 MINUTES: THOSE ATHLETES WHO MAY NOT BE AS STRONG.

- However, if the rest intervals are too long the greatest potentiation effects may dissipate leading to no change in performance.

2-3 MINUTES: THE FULL BENEFIT OF POTENTIATION (MORE POWER)

- (from Stone’s Study) both strong and weaker subjects displayed their best performance 2 minutes after the ballistic protocol

THE TEMPORAL PROFILE OF POSTACTIVATION POTENTIATION IS RELATED TO STRENGTH LEVEL

LAURENT B. SEITZ,^{1,2} EDUARDO S. DE VILLARREAL,³ AND G. GREGORY HAFF²

¹French Rugby League Academy, Toulouse, France; ²Center for Exercise and Sport Science Research, Edith Cowan University, Joondalup, Western Australia, Australia; and ³Laboratory of Human Performance, Faculty of Sport, University Pablo de Olavide, Seville, Spain

- “Shorter rest periods <2 minutes results in smaller responses to PAP when compared to rest periods or 3-5 minutes or even up to 7-10 minutes. After 10 minutes responses fell off to a certain degree.” level.”

- “When constructing PAP Complexes, Strength & Conditioning coaches should consider the time frame between the near max exercise and the performance activity in relation to the athletes strength level.”

“WHEN PLANNING YOUR PROGRAM”

- **When you want Athletes in your program to fight/resist fatigue:**
 - **“Shorter Rest Interval”**
 - However, realize the “Potentiation Effect” may not be as great (What about Werner Gunthor?)
 - **When Power is your Emphasis”**
 - 2-3 minute rest Interval to get the most out of Potentiation

“However, there is a Consensus on the weight that is used on the first Exercise of the Complex / Contrast Group.”

- Once again, Dr. Michael Stone and colleagues article used 90% of 1 RM
- “Complex & Contrast Training Methods for Speed and Power Athletes”. By Codie Bidlow. Also Suggest 90% on your resistance exercise.
- “The Temporal Profile of Post-activation Potentiation Is Related to Strength Level” by LB Seitz. Used 90% of 1RM with 3 reps of back squats

SETS AND REPS?

Once again there is a Consensus

- 2-5 SETS OF 2-3 REPS Just like any other program where Power is the Focus
- “Rate of Force Development” should not Diminish (with too much Volume it will)

**“Stronger
Athletes
express a
higher
degree of
PAP.”**

**From the research article: “The
Temporal Profile of Post-activation
Potentiation is Related to Strength
Level”**

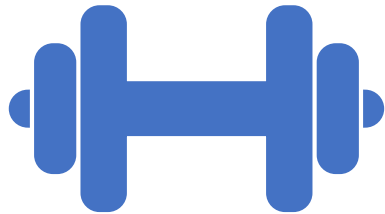
[Laurent B Seitz¹](#), [Eduardo S de Villarreal](#), [G Gregory Haff](#), “The temporal profile of postactivation potentiation is related to strength level”

**From the research article:
“Potentiation Effects of Half-Squats
Performed in A Ballistic or
Nonballistic Manner”**

[Timothy J Suchomel¹](#), [Kimitake Sato](#), [Brad H DeWeese](#), [William P Ebben](#), [Michael H Stone](#), “Potentiation Effects of Half-Squats Performed in A Ballistic or Nonballistic Manner”



TRAINING FREQUENCY



Due to the high Stress on the Central Nervous System, the Neuromuscular System needs at least 72 hours for full recovery.

We recommend once a week CT During the In-season

We recommend up to twice a week but no more in the Off-Season

When and Where to use Complex / Contrast Training in your PERIODIZATION MODEL?



Accumulation = Hypertrophy / 8-15 reps / 3-5 sets



Transmutation = Strength / 3-5 reps / 3-5 sets



Realization = Power / 2-3 reps / 2-3 sets



In season and off-season

CT Program Off/In Season

OFF SEASON (CT twice a week)

- Strength Days – Reps 2-3's
 - Exercises
 - Squat Variations
 - Dead Lift Variations
 - Bench Press Variations
 - Overhead Press
- Power Days – Reps 2-3's
 - Exercises
 - Pulls
 - Snatches/Cleans

IN SEASON (CT once a week)

- Blended
 - Power and Strength on the same day
- Perform CT with Cleans one week
- Perform CT with a Squat Variation the following week

TRAP BAR DL TO A BROAD JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

HIGH PULL TO A TUCK JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023



BACK SQUAT TO A TUCK JUMP

HANG CLEAN TO A BOX JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

PARTIAL SQUAT TO A HURDLES DEPTH JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Partial Bench Press to Clap Push ups



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Zatsiorsky: “The Science and Practice of Strength Training”

- Indicated that training with Partial ROM lifts may enhance peak force, rate of force development, and impulse in the ROM being trained as compared with only training with full ROM lifts.

FRONT SQUAT TO A HURDLE DROP JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

SINGLE LEG SQUAT TO SL VERTICAL



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

SPLIT SQUAT TO A SINGLE LEG BROAD JUMP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

SIDE LUNGE TO SKATER JUMPS



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Upper Body
SINGLE ARM
BENCH TO
SINGLE ARM
PUSH-UP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

RECIPROCAL DB BENCH PRESS TO A SINGLE ARM PUSH-UP



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Why Use CT in Your Training Program?

Where the Research Leads Us

Use of a strength-power potentiating complex of ballistic concentric-only half-squats increased squat jump height, peak power, and allometrically scaled peak power compared to non-ballistic and control condition. PAP increased jump height and peak power more and earlier in subjects who were stronger relative to bodyweight (Suchomel et al., 2015).



Suchomel, T. J., Sato, K., DeWeese, B. H., Ebben, W. P., & Stone, M. H. (2015). Potentiation following ballistic and nonballistic complexes: The effect of strength level. *Journal of Strength and Conditioning Research*, 30(7), 1825-1833. doi: 10.1519/JSC.0000000000001288

8-week programs utilizing complex training and contrast training increased strength, power, agility, and speed performance in young elite soccer players. Complex training and contrast training did not result in any decrease in speed over the course of the study, whereas traditional training showed significant decreases in sprinting speed at mid- and post-tests (Kobal et al., 2017).



Kobal, R., Loturco, I., Barroso, R., Gil, S., Cuniyochi, R., Ugrinowitsch, C., Roschel, H., & Tricoli, V. (2017). Effects of different combinations of strength, power, and plyometric training on the physical performance of elite young soccer players. *Journal of Strength and Conditioning Research*, 31(6), 1468-1476. doi: 10.1519/JSC.0000000000001609

PAP protocols using traditional lifting exercises or plyometric exercises effectively increase linear speed; back squats with loads of 60-90% of 1RM improved sprint times in distances from 10 m up to 100 m in professional athletes, college athletes, and strength-trained individuals (Lockie et al., 2018).



Lockie, R. G., Lazar, A., Davis, D. L., & Moreno, M. R. (2018). Effects of post-activation potentiation on linear and change-of-direction speed: Analysis of the current literature and applications for the strength and conditioning coach.

In elite ice hockey players, contrast training utilizing back squat and squat jump supersets significantly improved total sprint time, mean sprint speed, and first sprint speed for 9 40-m on-ice sprints performed 6-hours later (Legrange et al., 2020)

PAP may be a better option than conventional warm-up techniques for explosiveness; if combined with conventional warm-ups on the day of competition, PAP exercises improve power performance (Legrange et al., 2020).



International Journal of
EXERCISE SCIENCE

[Int J Exerc Sci.](#) 2020; 13(6): 183–196.

Published online 2020 Feb 1.

PMCID: PMC7039519

PMID: [32148640](#)

Contrast Training Generates Post-Activation Potentiation and Improves Repeated Sprint Ability in Elite Ice Hockey Players

Legrange, S., Ferland, P-M., Leone, M., & Comtois, A. S. (2020). Contrast training generates post-activation potentiation and improves repeated sprint ability in elite ice hockey players. *International Journal of Exercise Science*, 13(6), 183-196.



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power



When 8-week in-season programs using contrast training and plyometric training were compared for junior soccer players, contrast training was most effective at improving sprint performance, force-velocity values, and quadriceps activation (Hammami et al., 2019).

Contrast training likely induces neuromuscular changes that improve neural drive to agonist muscles, improve intermuscular coordination, and improve motor unit firing frequency, rate coding, and impulse synchronization. This explains the increase in EMG activity with contrast training programs (Hammami et al., 2019).

ORIGINAL RESEARCH

Effects of Contrast Strength vs. Plyometric Training on Lower-Limb Explosive Performance, Ability to Change Direction and Neuromuscular Adaptation in Soccer Players

Hammami, M., Gaamouri, N., Shephard, R.J., & Chelly, M.S. (2019). Effects of contrast strength vs. plyometric training on lower-limb explosive performance, ability to change direction, and neuromuscular adaptation in soccer players. *Journal of Strength and Conditioning Research*, 33(8), 2094-2103. Doi: 10.1519/JSC.0000000000002425.

Increase in seated
medicine ball
throw test and
vertical jump
performance in
academy soccer
players

The screenshot shows the PubMed.gov interface. At the top, the NIH logo and 'National Library of Medicine' are displayed. Below that is the PubMed.gov logo and a search bar. The search results section shows a link to the article: '> Int J Sports Physiol Perform. 2021 Aug 1;16(8):1134-1139. doi: 10.1123/ijsp.2020-0139. Epub 2021 Feb 14.' The article title is 'Effect of 10 Weeks of Complex Training on Speed and Power in Academy Soccer Players'. There are 'Save' and 'Email' buttons on the right side of the search bar area.

Gee, T. I., Harsley, P., & Bishop, D. C. (2021). Effect of 10 Weeks of Complex Training on Speed and Power in Academy Soccer Players. *International journal of sports physiology and performance*, 16(8), 1134-1139. <https://doi.org/10.1123/ijsp.2020-0139>

Decreased sprint times as well as increased jump performance and change of direction ability in professional level male soccer players



The screenshot shows the PubMed.gov interface. At the top, the NIH logo and 'National Library of Medicine National Center for Biotechnology Information' are visible. Below that is the PubMed.gov logo and a search bar. The search results section shows a link to 'Front Psychol. 2021 Jan 22;11:627869. doi: 10.3389/fpsyg.2020.627869. eCollection 2020.' followed by the title 'Effects of Complex Training on Sprint, Jump, and Change of Direction Ability of Soccer Players: A Systematic Review and Meta-Analysis' in bold black text.

Thapa, R. K., Lum, D., Moran, J., & Ramirez-Campillo, R. (2021). Effects of Complex Training on Sprint, Jump, and Change of Direction Ability of Soccer Players: A Systematic Review and Meta-Analysis. *Frontiers in psychology*, 11, 627869. <https://doi.org/10.3389/fpsyg.2020.627869>

AFTER ALL THE POSITIVE RESEARCH

**WHY NOT COMPLEX /CONTRAST TRAINING
IN YOUR PROGRAM??**



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power



LOGISTICS

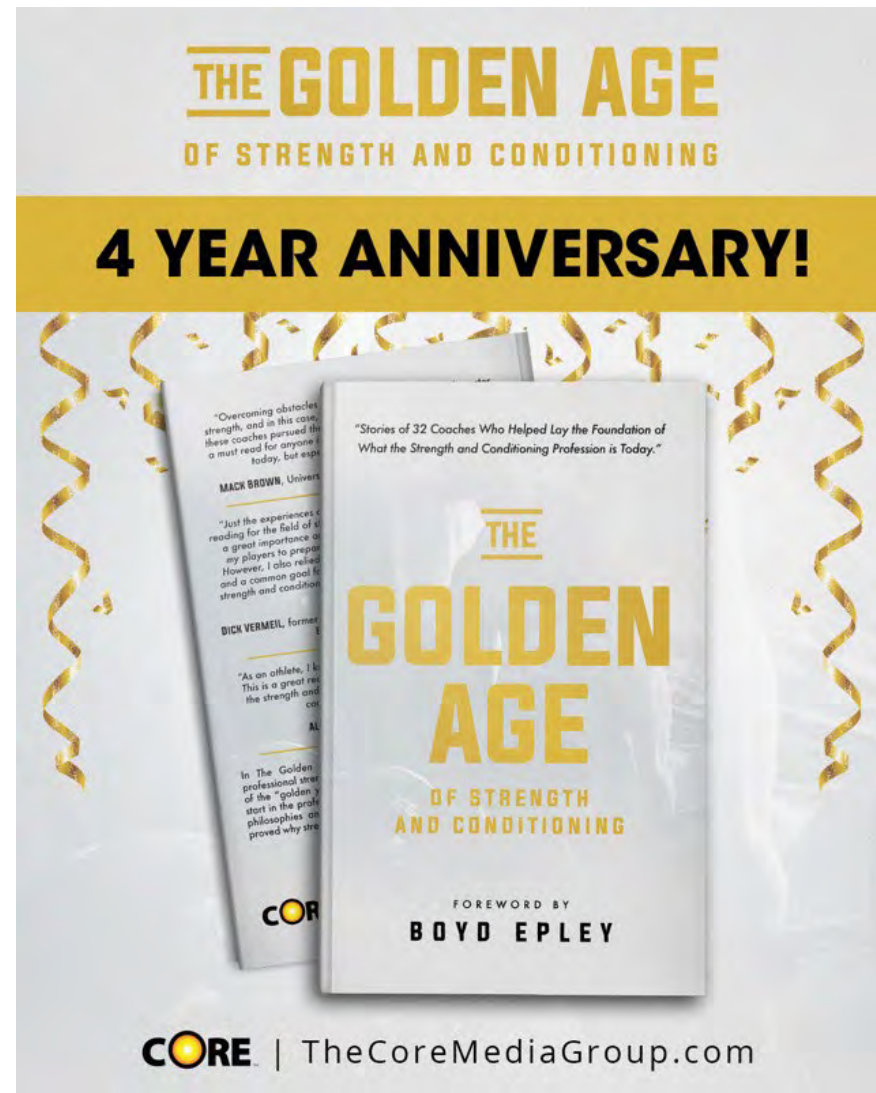
1983



2022



THE GOLDEN AGE OF STRENGTH & CONDITIONING



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power



Three Take Aways

- 1. POTENTIATION COMPLEXES SHOULD BE INCORPORATED INTO YOUR STRENGTH / POWER and/or AN EXPLOSIVE SPEED TRAINING BLOCK**
- 2. FATIGUE SHOULD DISSIPATE BEFORE PERFORMING THE TARGET EXERCISE. 2 -3 MINUTE REST TO GET THE FULL EFFECT OF “POTENTIATION”**
- 3. MAXIMUM EFFORT MUST BE EMPHASIZED WHEN USING SUB MAXIMUM LOADS ON THE TARGET EXERCISE**

PHONE NUMBER:
(704) 231-8648

WEBSITE:
www.chipsigmon.com

**FACEBOOK: Chip
Sigmon**

INSTAGRAM:
@trainwithchip



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

NSCA **COACHES**
CONFERENCE 2023

Never Negotiate with WEAKNESS



Chip Sigmon, CSCS, ISSN, RSCC*E
Contrast Training Another Tool for Explosive Power

