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IMG ACADEMY

“Sport Science Applications To Sports
Conditioning, Speed Development”

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INTEGRATION OF SPORT SCIENCE IN STRENGTH & CONDITIONING

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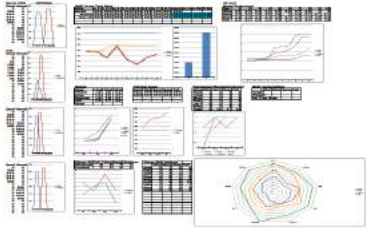
ROLE OF SPORT SCIENCE IN S&C

- Read, Analyze, Synthesize the literature to ensure optimal programming
- Assessment of athletes
- Interpretation and presentation of data to S&C coach for use in individualization of training
- Work with S&C coach to innovate



ATHLETE ASSESSMENTS

PLAYER PROFILE IS USED TO IDENTIFY STRENGTHS, WEAKNESSES, LIMITATIONS.



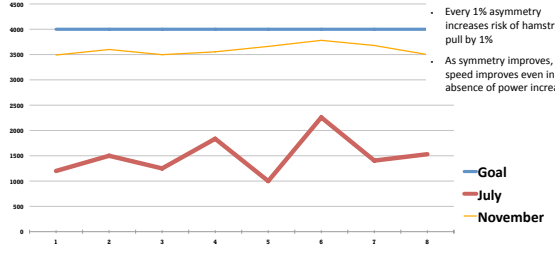
S&C COACH AND SPORT SCIENTIST INTERACT TO DETERMINE BEST APPROACH FOR ATHLETE DEVELOPMENT.

OUR GOAL IS TO FIND WHAT IS LIMITING PERFORMANCE. THEN WE CAN ATTACK THAT LIMITATION AND WATCH PERFORMANCE IMPROVE.

HAMSTRING INJURIES AND SPEED



SPLIT JUMP TESTING

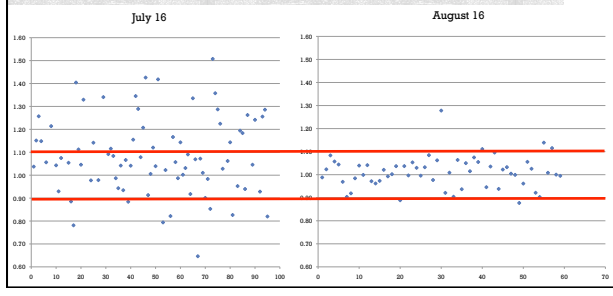


Trial	Goal	July	November
1	4000	1200	2500
2	4000	1500	2600
3	4000	1300	2500
4	4000	1800	2600
5	4000	1000	2600
6	4000	2200	2700
7	4000	1400	2600
8	4000	1500	2500

- Every 1% asymmetry increases risk of hamstring pull by 1%
- As symmetry improves, speed improves even in the absence of power increase

Legend: Goal (Blue), July (Red), November (Yellow)

CHANGES IN HAMSTRING RATIOS





SPECIFICITY OF TRAINING

- Mel Siff detailed this concept in a more complex, neurophysiologic manner
- "it is vital to remember that all exercise involves **information processing** in the central nervous and neuromuscular systems, so that all training should be regarded as a way in which the body's extremely **complex computing systems** are programmed and applied in the solution of all motor tasks".
- Supertraining



COMPLEXITY OF THE NEUROMUSCULAR SYSTEM

Training presents specific stimuli that can promote improved function in one or more of these factors

- Information gathering and interpretation
 - Response generation
 - Muscle Activation
 - Proprioception
 - Graded response
 - Muscle coordination
 - Motor unit synchronization
- Altered responses based on environmental variations

TRANSFER OF TRAINING

- The degree to which an exercise transfers to a specific skill
- Relates to specificity of training
- Transfer may be a good measure of "specificity"
- The greater the transfer, the greater the value to a specific athlete

MEASURING TRANSFER

Zatsiorsky proposed the following equations:

$$\text{Transfer} = \frac{\text{Improvement in skill}}{\text{Improvement in exercise}}$$

$$\text{Result Gain} = \frac{\text{Gain in performance}}{\text{Standard deviation of performance}}$$

Zatsiorsky, VM (1995). *Science and Practice of Strength Training*. Human Kinetics: Champaign, pgs. 9-11.

Vertical Jump	RANK	Exercise	
	2	Band back squat (quarter depth)	1.92
			1.47
			1.3
			1.13
			1.01
	27	Back squat parrallel	0.57
31	Snatch	0.42	

Gauge your objectivity!

MEASURING TRANSFER

STANDING COMBAT:

		1.59
		1.50
		0.98
		0.62
		0.42
		0.37
35	Depth jump	0.36
36	Deadlift	0.36
38	Clean Jerk	0.33
40	Bench press	0.32

Gauge your objectivity!



Gauge your objectivity!

JOINT-ANGLE SPECIFIC ADAPTATIONS

- 16 Weeks
- 30 College Athletes >300lb squat 1RM
- Training groups
 - Quarter squats
 - Half squats
 - Full squats
- Measured changes in strength at all 3 depths
- Measured VJ and sprinting speed changes Pre/mid/post

HUMAN MOVEMENT
2016, vol. 17(2), pp. 18

JOINT-ANGLE SPECIFIC STRENGTH ADAPTATIONS INFLUENCE IMPROVEMENTS IN POWER IN HIGHLY TRAINED ATHLETES

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% CHANGES

Vertical Jump		Mid-Test		Post-Test	
Group	Mean	SD	Mean	SD	
QTR	0.08	0.06	0.16	0.11	
HALF	0.02	0.02	0.08	0.07	
FULL	0.00	0.02	0.02	0.03	
40 Speed		Mid-Test		Post-Test	
Group	Mean	SD	Mean	SD	
QTR	-0.01	0.01	-0.02	0.01	
HALF	-0.01	0.00	-0.01	0.01	
FULL	0.00	0.00	0.00	0.01	

TRANSFER

Group	VJ	Sprinting
QTR	0.63	-0.56
HALF	0.44	-0.67
FULL	0.18	-0.21

CONCLUSIONS

- The deeper the squat, the less it transfers to jumping and sprinting
- Consider transfer, value, and Stress
 - Do squats at different depths have different value?
 - Deeper squats = more glute activation
 - Caterisano, A, Moss, R, Fellinger, T, Woodruff, K, Lewis, V, Booth, W, and Khadra, T. The effect of back squat depth on the EMG activity of 4 superficial hip and thigh muscles. / *Strength Cond Res* 16:428-432, 2002.
 - Different stresses at each different range of motion. Variation of stress?
 - Otr squats = greater anterior shear
 - Full squats = greater posterior shear
 - Schoenfeld, BJ Squatting kinematics and kinetics and their application to exercise performance. / *Strength Cond Res* 24:3497-3506, 2010.

JOINT-ANGLE SPECIFICITY

- Angles trained?
- Angles overloaded?
 - If training loads calculated based on full squat 1RM, loads in quarter squat angles represent only 60-70% of strength capacity at those angles

Full Squat 1RM	Quarter Squat 1RM
172 kg 88% = 146 kg	232 kg 146 kg = 62%

*****JOINT-ANGLE OVERLOAD*****

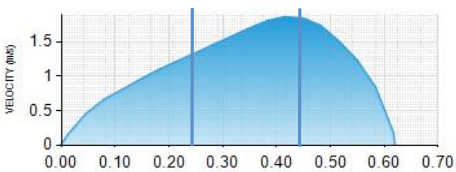
Loads must be calculated based on the 1RM at the depth to be trained!



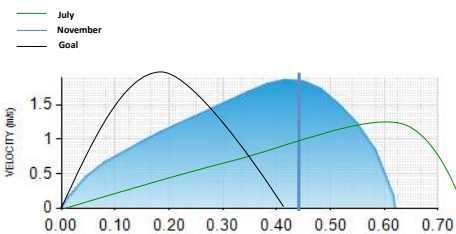
VELOCITY BASED TRAINING

- Speed is a primary differentiator between players in football so it should be the focus of our development program
- Because exercise readiness changes differently for each player throughout the week, prescribing specific loads is not optimal
- Periodization of speed (at whatever load is appropriate that day)
- **Speed Strength (1.0 - 1.3 m/s)** - Utilizing lighter loads at very fast velocities, speed is first priority with strength being second
- **Strength Speed (.75 - 1.0 m/s)** - Moving a moderate heavy weight as fast as possible
- **Accelerative Strength (.50 - .70 m/s)** - Driving against a heavy load as fast as possible
- **Absolute Strength (.20 - .50 m/s)** - Ability to exert force maximally and move towards increasing 1RM

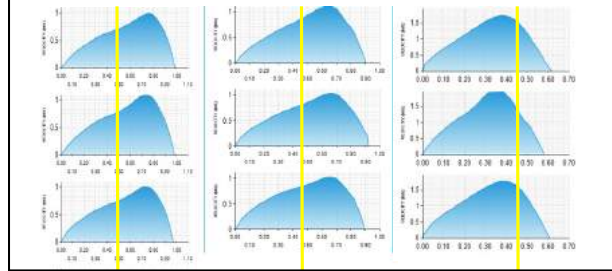
ELITE FORM DATA: MORE THAN JUST VELOCITY



INDIVIDUAL VELOCITY PARAMETERS



CHANGE IN SPEED SQUAT CURVES DURING SEASON



KEY POINTS

- Sport science can play a positive role in S&C
 - ...far more than just GPS data
- Great S&C coaches have a scientific mind, with the ability to integrate information into consistent evolution

