'Physical Preparation for Developing Throwers'

LAURA KERR

WELSH ATHLETICS CONFERENCE 2019

Background

- Athletics NI Coach Development & Physical Preparation Lead
- MSc Human Performance
- Accredited Strength & Conditioning Coach
- Personal Coach-Javelin, Shot & Combined Events
- Team Coach (NI/GBR/AAI)
- Former Collegiate Athlete (NCAA Javelin)

Athletics Northern Ireland

Belief: A movement skills & multi event approach through early teens (12-14) will enhance athletic development & create more physically prepared senior athletes

Aim: to increase retention of teens in one or more events at event group stage (15-17) and insure they are robust enough to tolerate loads of event specific training (17+,) possess a resilient mindset and have a support structure that enables progress.

Delivery:

- Rising Stars Multi Event Initiative established 2014
- Youth Academy established 2014

https://photos.app.goo.gl/VisvhrRtfYBWFqnQ6

- Resistance Training for Youth-Dispelling Myths
- Strength Training and Injury Risk
- Demands of Throwing
- Physical Competence & Exercise Progression
- Calisthenics and Gymnastics
- Weight Room Training
- Plyometrics
- Medicine Ball Training

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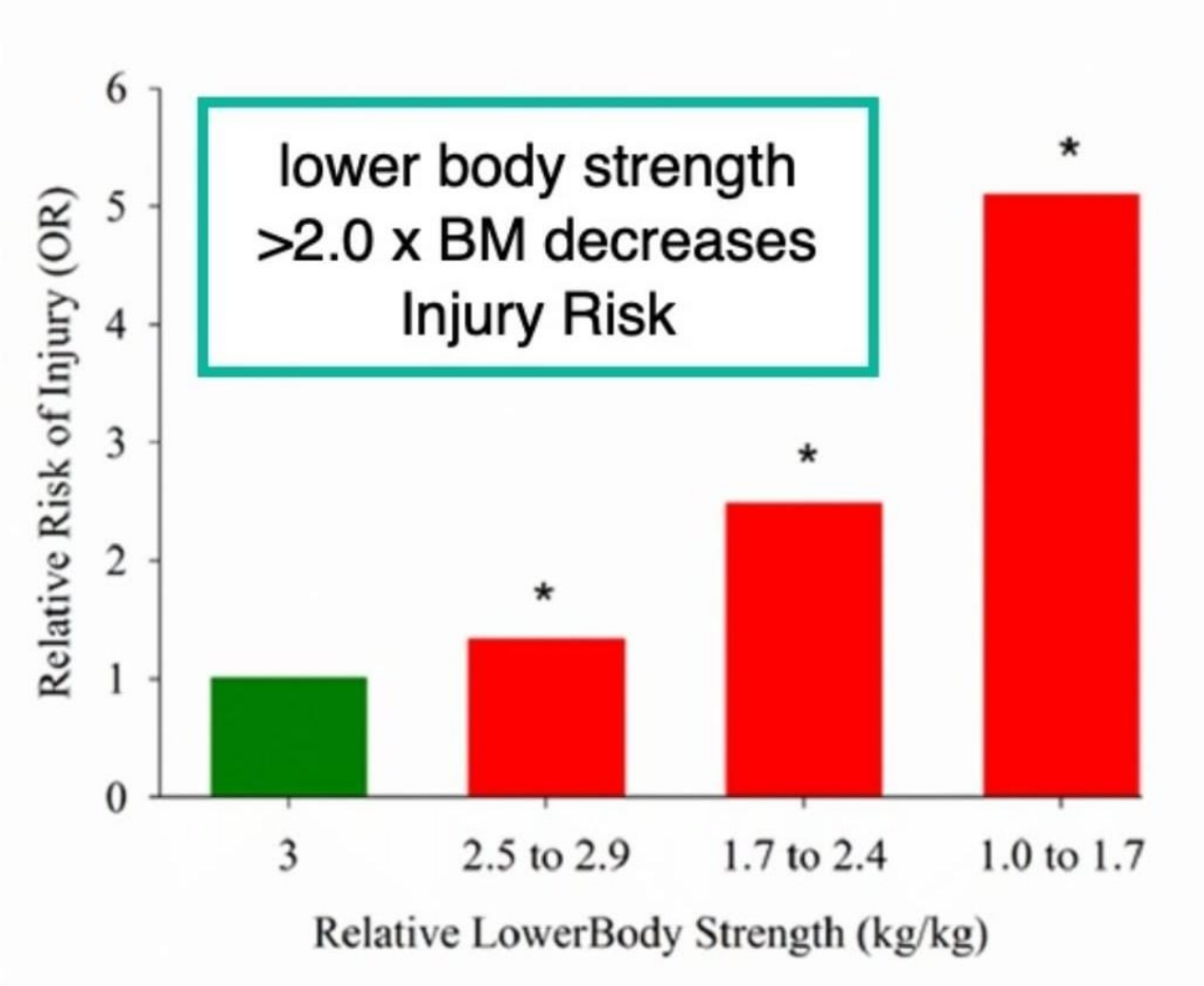
Youth Resistance Training- What are the Myths?

The Ultimate Pill

Adapted from: Avery Faigenbaum (@afaigenbaum)

Resistance training, can enhance bone mineral density and reduce sports-related injury risk in young athletes.

Strength Training and Incidence of Injury



These findings demonstrate that well-developed lower-body strength assessed by Trap Bar Deadlift Max relative to Body Mass was associated with reduced risk of injury in athletes measured over a 2 year period.

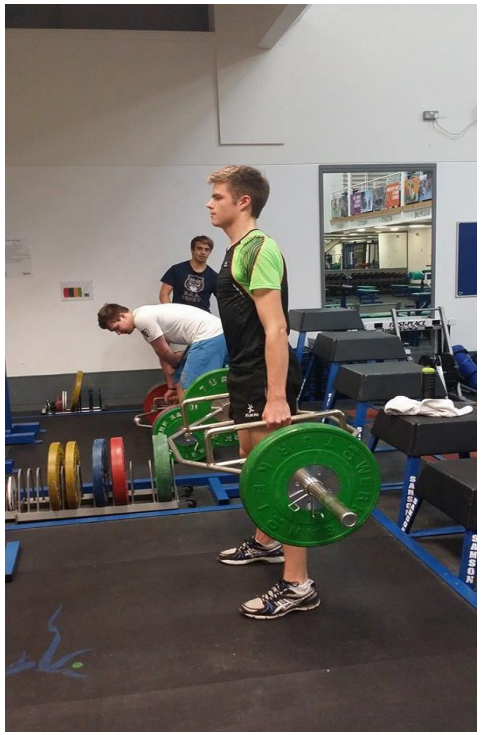
J Sci Med Sport. 2019 Jan 22

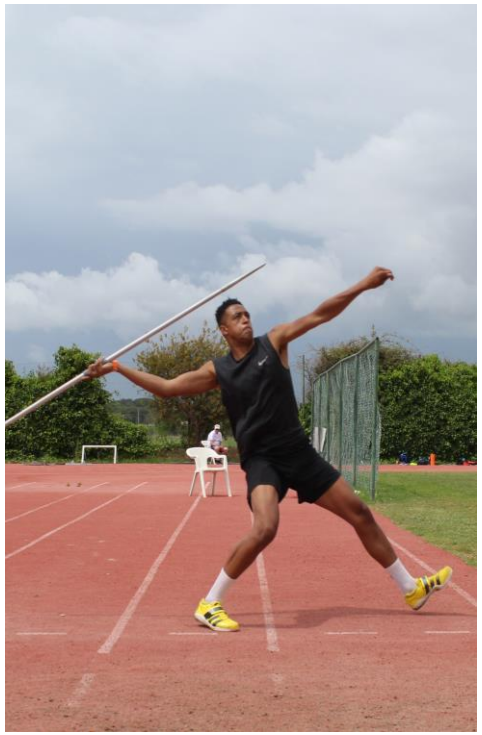
Youth Resistance Training- Dispelling Myths

UKSCA Position Statement: Youth Resistance Training

Rhodri Lloyd with Avery Faigenbaum, Greg Myer, Michael Stone, Jon Oliver, Ian Jeffreys, Jeremy Moody, Clive Brewer & Kyle Pierce

- “Fears that resistance training would injure the growth-plates of youths are not supported by scientific reports, which indicate that the mechanical stress placed on the developing growth plates from resistance exercise, or high strain eliciting sports such as weightlifting, are actually beneficial for bone formation and growth”
- “No scientific evidence indicates that resistance training will have an adverse effect on linear growth during childhood or adolescence, or reduce eventual height in adulthood”





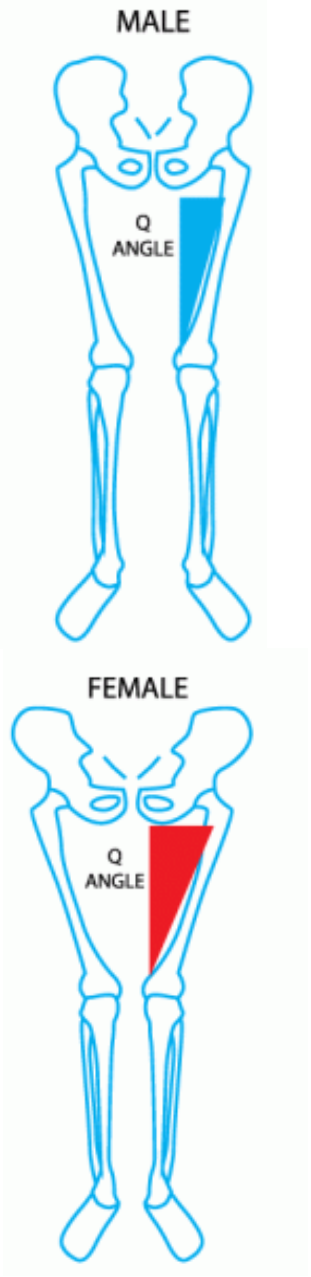
Javelin-A *force* six to eight times the athlete's *body* weight is created at front foot contact.

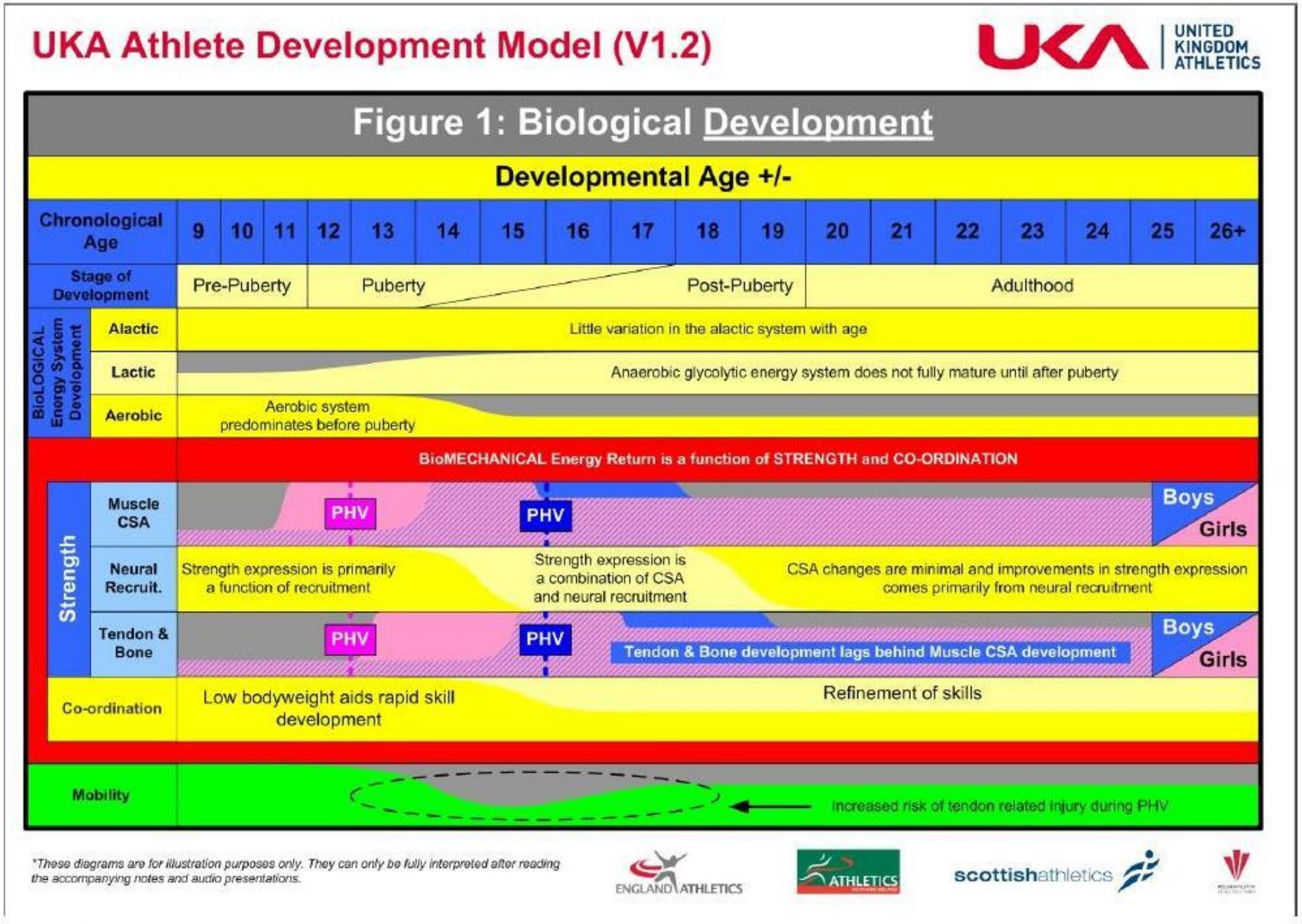
Which is more likely to cause injury?

UKSCA Position Statement: Youth Resistance Training

Rhodri Lloyd with Avery Faigenbaum, Greg Myer, Michael Stone, Jon Oliver, Ian Jeffreys, Jeremy Moody, Clive Brewer & Kyle Pierce

- School PE Curriculums make little mention of resistance training
- Muscular strength levels of children within the United Kingdom are decreasing.
- Such a tendency of declines in muscular strength levels is commensurate with other European countries yet muscular strength is an essential component of motor skill performance
- Musculoskeletal growth during puberty, in the absence of corresponding neuromuscular adaptation, may facilitate the development of abnormal joint mechanics and injury risk factors in young girls.
- These intrinsic risk factors, if not addressed at the proper time, may mean the musculoskeletal system of some aspiring young athletes may not be prepared for the demands of sports practice and competition continue predisposing female athletes to increased risk of injuries.
- In a recent longitudinal study, noted that young females who did not participate in resistance training programmes as they matured developed injury risk factors.
- Strength gains of 30-40% are typically observed in untrained youth following participation in an introductory resistance training programme.





Gains in muscular strength before puberty appear to depend upon neural adaptations.

During adolescence the effects of resistance training appear to be a result of additional gains in lean body mass and muscle cross-sectional.

Among children that very special care should be taken in their development, and coaches should avoid using training methods aimed at increasing overall muscle mass, instead focusing on strength development and movement skill competency.

Recommendations

- Childhood is deemed to be a crucial time in which to develop movement competency, as it is during these formative years that neuromuscular coordination is most susceptible to change
- When training age is low overall fundamental movement competency should be the aim-try to ensure the athletes coming to your programmes 15+ have a good foundation. *What is the training experience of athletes coming to you?*
- *Squat/lunge/hinge/brace/push/pull/rotate-* warm ups are an ideal opportunity
- https://youtu.be/gU_tVU_0vlw
- https://youtu.be/eIJKceuvqAQ
- Use more complex movement flow warm ups and calisthenics to maintain body control
- https://youtu.be/nPIKtuAOATM
- https://youtu.be/jbEAVC35CME
- When introducing load use free weights-more muscle recruitment and activation-more motor skill requirement
- Once technical competency is demonstrated shift focus to force generation-
- https://youtu.be/mA7I_YIoHlI

Strength is a product of muscular, neural and biomechanical factors

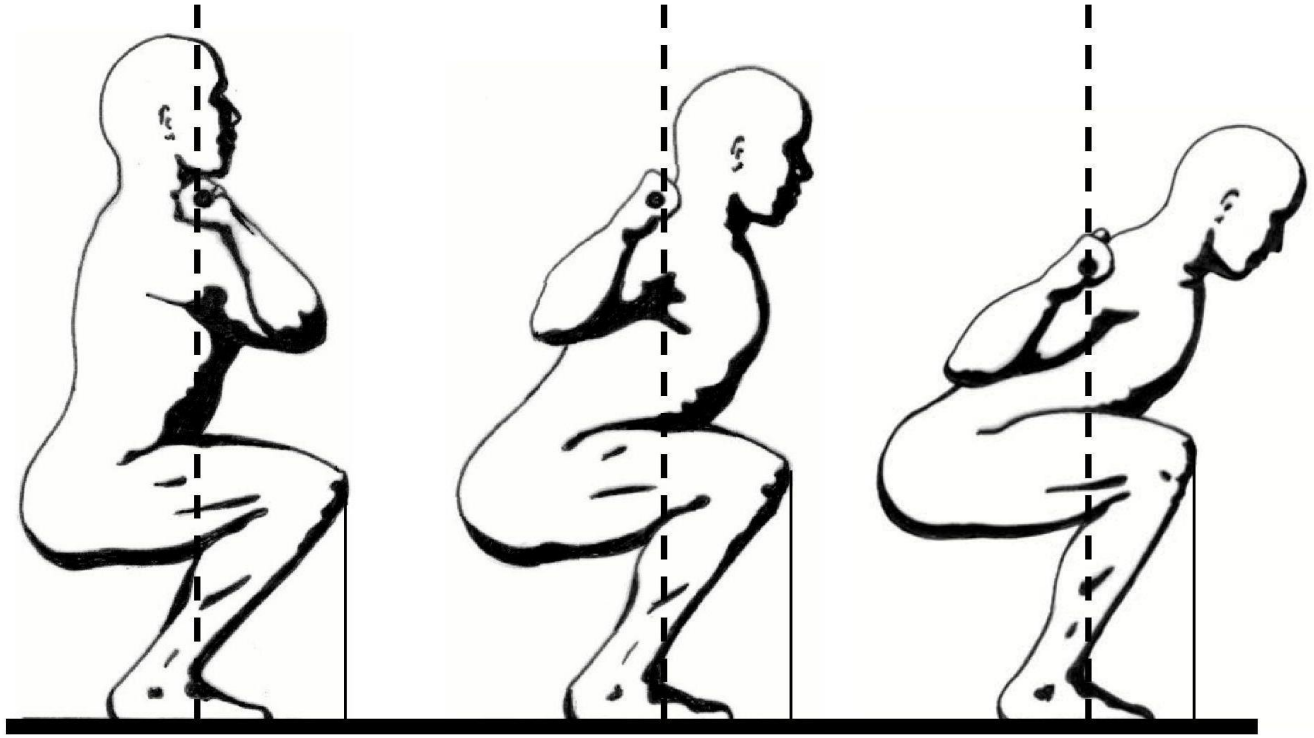


Figure 2-31. Bar position ultimately determines back angle, as seen in this comparison of the front squat, the high-bar squat, and the low-bar squat. Note that the bar remains balanced over the mid-foot in each case, and this requires that the back angle accommodate the bar position. This is the primary factor in the differences in technique between the three styles of squatting.

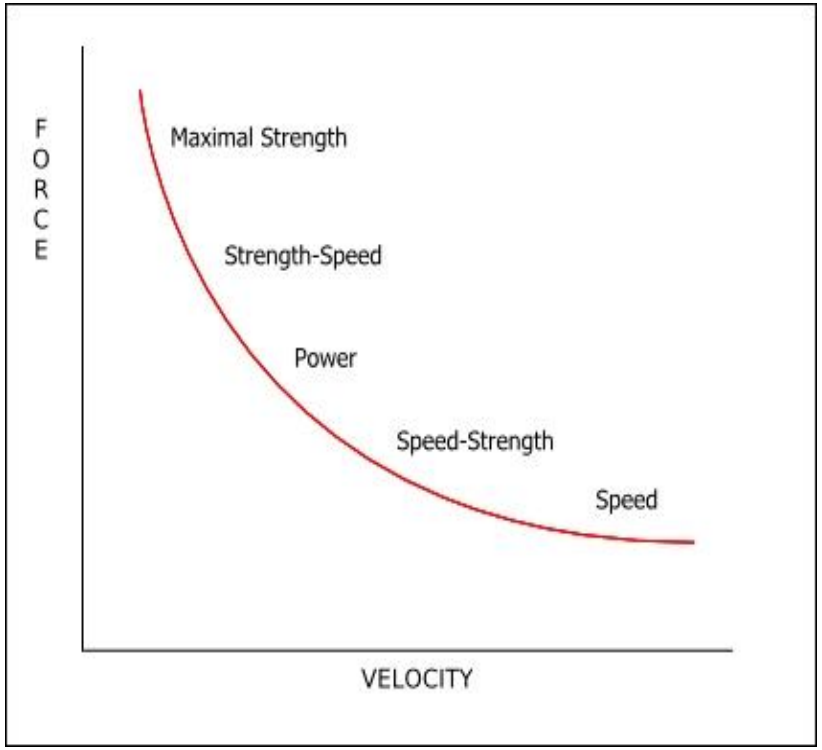
UKSCA Position Statement: Youth Resistance Training-Loading Recommendations

Training Experience	Beginner	Intermediate	Experienced	Advanced
Volume (sets x reps)	1-2 x 8-12	2-4 x 6-10	2-4 x 5-8	2-5 x 2-5
Total number of exercises per session	6-10	3-6	3-6	2-5
Intensity (%1RM)	Body weight, or 50-70% 1RM	60-80%	70-85%	85-100%
Repetition Velocity (speed of movement)	Moderate-Fast	Moderate-Fast	Fast-Maximal	Maximal
Rest intervals (minutes)	1	1-2	2-3	2-5
Frequency (sessions per week)	2-3	2-3	2-4	2-5
Recovery (hours in between sessions)	72-48	72-48	48	48-24

- The relationship between volume and intensity is inverse in nature; the greater the load (intensity), the lower the number of repetitions that can be completed (volume)
- Both variables must be considered when prescribing resistance training for youth, however, training intensity is arguably more important owing to the injury risk associated with exposing a child or adolescent to excessive external loading at the expense of correct technique-**do not load dysfunction**

Terminology

- **Strength-is the ability to generate force**
- **Power-is a product of force and velocity**
- **In explosive sports the Rate of Force Development (RFD) is paramount**
- **RFD = The ability to generate muscle tension in a short period of time.**
- **Power is skill-related - increased strength does not always translate into increased power**
- **In throwing as implement mass increases the velocity slows**



Athletics N.I Youth Academy-Weight Room Approach

Technical Development

Competency/Motor Skill

Low Loads

Structural Balance/Strength

Increasing loads to increase force generation

Antagonists

Max Strength

Loads are near maximal

High force outputs

Light Power

Increasing rate of force development with low loads

Heavy Power

Increasing rate of force development with moderate-heavy loads

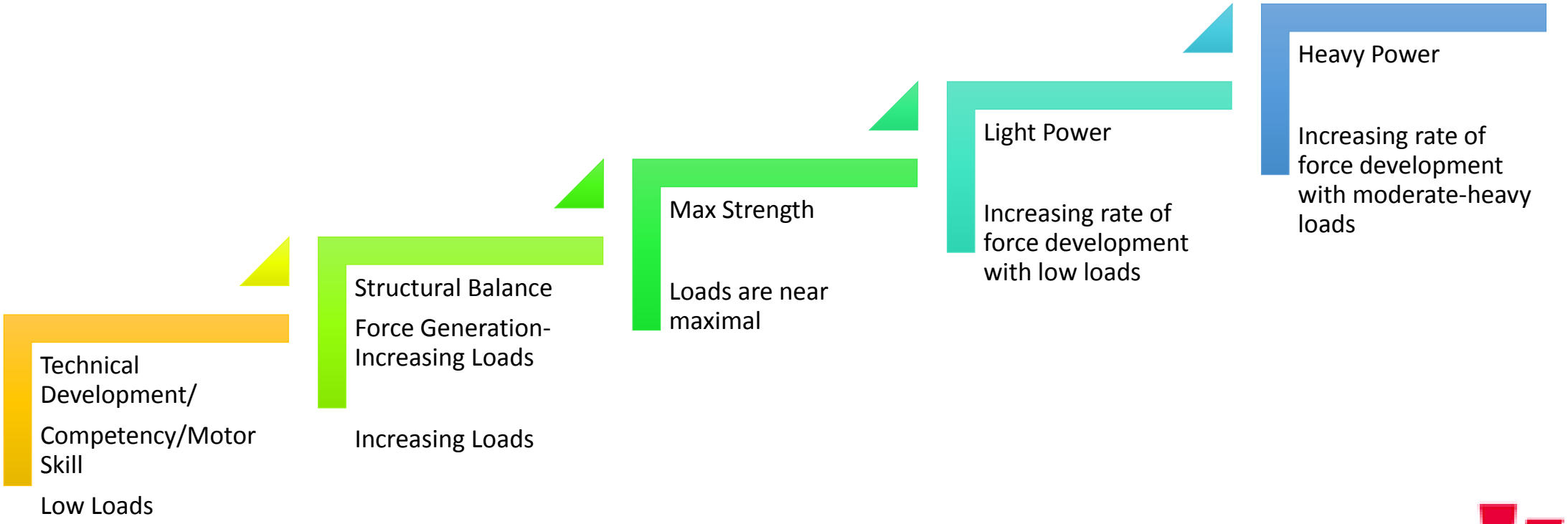
*Bilateral lower body example

TUT (s)	Strength Zone	Strength Method	Target Strength Ability	Rep	Intensity	Set Range * Sets to	Tempo E:P:C	Interset Rest
< 10	Zone 1	Reactive Strength	Stretch Shorten Cycle Ability	6-10	Body Mass	3-6	Short-Long	1-2
		Heavy Power	Maximal Muscle Power	3-6	60-80%	4-6	Fast	1.5-3
		Heavy RFD	Late Rate of Force Development	3-6	60-80%	4-6	Fast	1.5-3
		Light Power	Maximal Muscle Power	5-8	20-60%	5-8	Fast	1-2.5
		Light RFD	Initial Rate of Force Development	5-8	20-60%	5-8	Fast	1-2.5
		Eccentric Decel/Braking	Eccentric Rate of Force Development	3-5	Body Mass-60%	3-5	X:1-3:1	1-2.5
5-20	Zone 3	Maximal Strength	Maximal Muscle Strength	1-5	90-100% (Very Heavy)	3-5 ***	2-4:1-3:X	2.5-5
		Maximal Eccentric Strength	Maximal Eccentric Muscle Strength	3-5	90-110% (Very Heavy)	3-5 ***	2-10:0:A	2.5-5
20-40	Zone 2	Max Rep Exhaustive	Muscle Hypertrophy	5-12	70-85% (Heavy)	3-4 ***	2-4:1-3:1-3	2-3
		Max Set Exhaustive	Muscle Hypertrophy	5-12	50-70% (Moderate)	5-10 **	1-3:1-2:1-3	1-2
		Assistant Strength	Structural Balance	8-15	60-80% (Moderate)	2-4	1-3:1-3:1-3	1-2
		Slow Tempo Exhaustive	Muscle Hypertrophy	5-8	60-80% (Moderate)	3-5	4-6:1-3:4-6	1-3
40-60		Low Load Exhaustive	Muscle Hypertrophy/Strength Endurance	15-30	30-60% (Light)	2-4	1-2:0:1	2-3
		Technical Development	Movement Competency/Motor Control	2-8	Light	3-10	NA	1-2

Neural Adaptations

Muscle Morphology Adaptation

Task: Select exercises to develop strength abilities for a vertical press *or* single leg drive



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	Phase 1 Improving movement Skills and ROM		
Pattern	**1**	**Progression 2**	**Progression 3**
Split stance/single support	KB Split Squat	KB reverse lunge	KB Rear Foot Elevated Split Squat
Double leg squat	KB Paused Goblet Squat	KB Goblet Squat	T BAR
Hinge	Stick Hinge	KB Hinge	Barbell RDL
Horizonal Push	Rack Push Up	Box push up	Push Up
Horizonal Pull	Bent Knee Inverted Row	Straight Leg Inverted row	Inverted Ring Row
Hip dominant posterior chain	Double bench hip bridge	Back Extension on GHR	Prone Hold
Knee dominant posterior chain	Hip bridging	Heel walks	Heel Val slides
Lower Limb	Standing calf raise	Standing Calf raise with heel drop	Single leg calf raise
Prone Brace for time	Box crawl hold	box crawl shoulder tap	Push up hold
Lateral Brace	Side plank from knee	Side plank from knee with top leg hold	Side plank from knee with leg raises
Hip Abduction	Lying clams	Lying straight leg raise/Lying hip circles	Monster Walks
Ground based lumbo pelvic control	Reverse Sit up	Deadbug -arms only	Deadbugs with aletrante legs

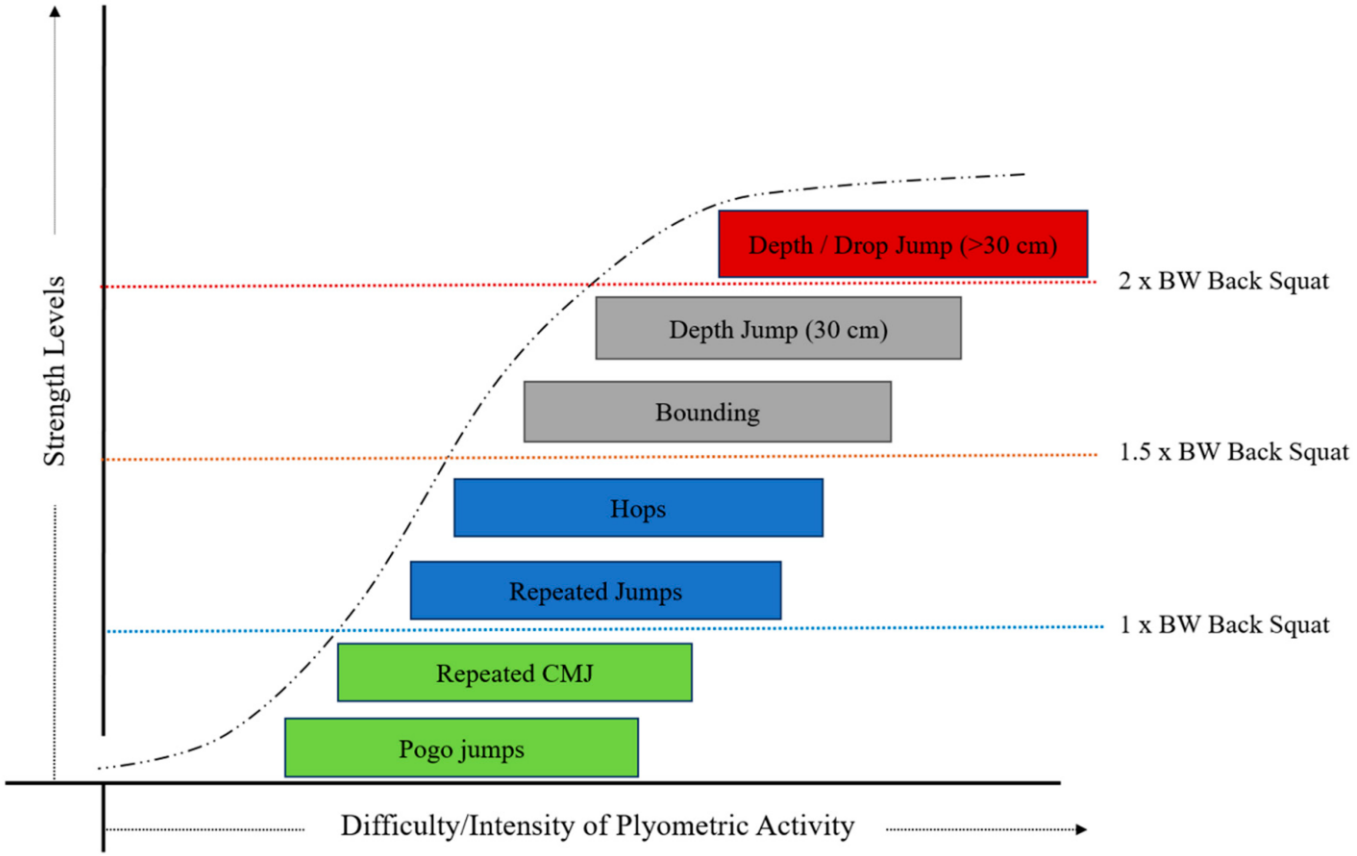
Step 1. Determine Training Phase and desired outcomes
Step 2. Determine essential movement patterns
Step 3. Develop a progression and regression exercise for each pattern

To progress increase load, range over which force must be applied or decrease base of support

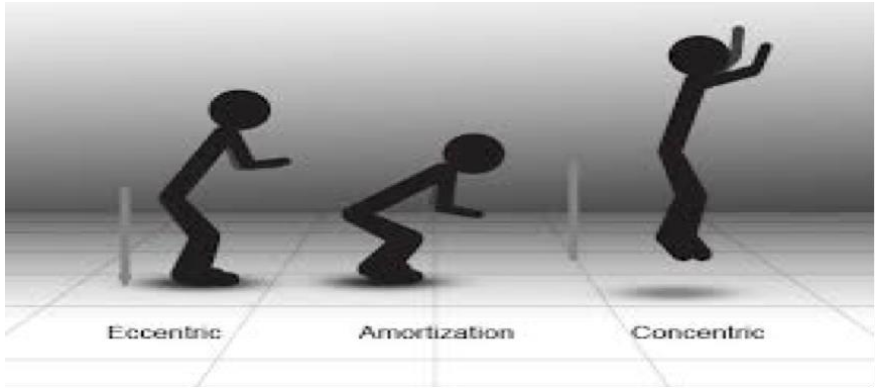
	Phase 2 Increasing force production capabilities		
Pattern	**1**	**Progression 2**	**Progression 3**
Split stance/single support	Barbell reverse lunge to high knee	box step up	reverse lunge-high knee-step up
Double leg squat	Front Squat	Front Squat^^	Back Squat
SL hinge	Single leg stick hinge	SL KB RDL	SL RDL
Horizonal Push	Loaded Push Up	DB Bench Press	Barbell Bench press
Vertical Pull	Hanging Retraction	Band assisted pull up	BW Pull Up
Hip dominant posterior chain	Single leg double bench hip bridge	Single leg extensions	loaded single leg extensions
Knee dominant posterior chain	Nordic hamstrings eccentric only ^	Razor curls	Nordics with return
Lower Limb-gastroc	Smith Rack Standing Calf Raise	SL smith rack standing calf raise	
Lower limb-soleus	Seated smith rack calf raise	SL Seated smith rack calf raise	
Prone Brace for time	Shoulder tap push up	plank	inchworm walk out
Hip Abduction/Lateral brace	Banded Lying clams/ Monster walk variations	copenhagens from knee	Copenhagens from foot
Hanging Lumbo Pelvic Control	Hanging pelvic tilts	Hanging single leg switches	Hanging double knee raise
Anti Rotation	Palof Press	KB carries	Cable chops
Rotational Trunk	Windsheild Wipers	Barbell Rotations	Cable Rotations

	Phase 3 Increasing Power			
Utilize exercises above to increase strength by increasing loads and consider inlclusion of following to improve expression of force quickly dependant on relevance to event				
	1	**Progression 2**	**Progression 3**	
Power Clean Progression	Mid Thigh Shrug	Mid thigh shrug to high pull	Hang clean from mid thigh	Hang clean from above knee
T Bar Jumps (30-40%)	T BAR single jump and stick	Continous T Bar Jumps		
Jerk Progressions	Barbell press	Barbell push press	Barbell push jerk	Split Jerk
Snatch Progressions	OH Squat	Pressing Snatch Balance	Drop Snatch	Mid Thigh Snatch Shrug

What Determines Exercise Selection for Plyometrics?



Theoretical relationship between strength and the optimization of plyometric exercise performance. Adapted from Suchomel et al. [93], Buchner et al. [99], and Haff [100] BW = body weight.

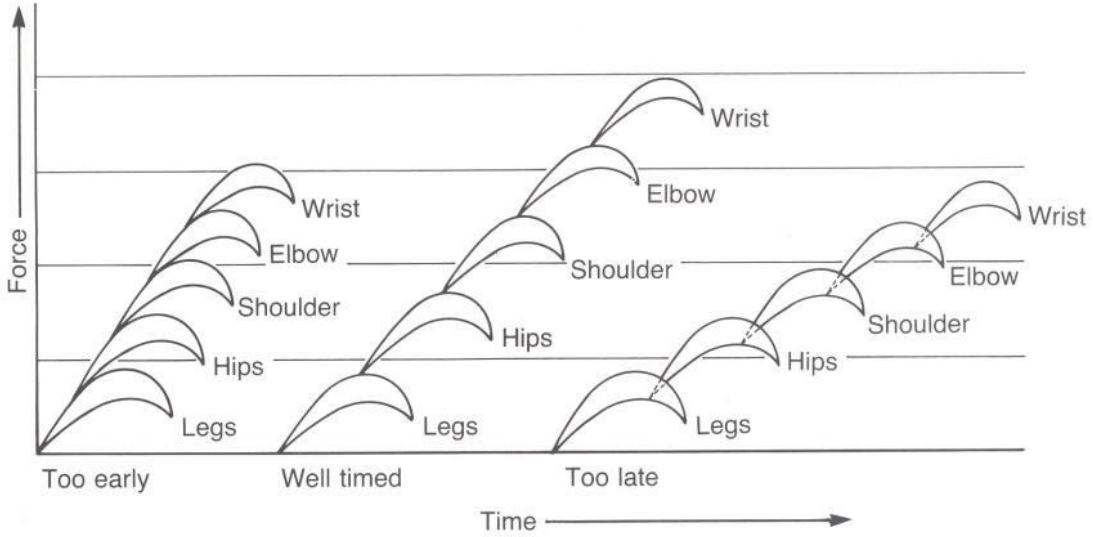


To be truly plyometric in nature there must be a rapid stretch shortening cycle and GCT of <0.2s

Rationale for Medicine Ball Training

- Throwing a medicine ball is an expression of power
- Requires sequential acceleration similar to shot, javelin, discus & hammer (coordination)
- Toe nails to finger nails
- Bridges the gap from weight room
- Unlike barbell exercises multi throws allow the athlete to accelerate through the release

Summation of Forces Principle



Summation of forces in the shot put

To gain maximum momentum the force is generated by using as many segments of the body as possible, in the correct order through the greatest range of motion to allow maximum force to be applied to the object

Event Specific Demands

Javelin

Mobility

- Thoracic extension and rotation
- External shoulder rotation
- Hip mobility

Speed/Elasticity

- Runway speed of 7-8ms

Strength/Power

- Whole body strength to transfer forces from runway to implement with a high release velocity
- Eccentric leg strength to block/decelerate- 6/8 x BW of force at FFC
- Trunk strength

Balance/Tolerance/Injury Resistance

- Rotator cuff
- Adductors/abductors

Jack Magee U23-Irish Universities Javelin Record/BUCS Bronze 2018

Specificity

- Throwing implements is the most specific thing you can do
- It is not ideal to attempt to replicate throwing techniques in the gym where increased time for execution will significantly impact technical model
- Specificity may increase with a more specific focus on direction of force and sequencing of muscles
- Don’t train specifically in the early years at the expense of neglecting major movement patterns, robustness and whole body control
- Beware of fatiguing the muscles that will be predominantly used in throwing

Javelin

- Pullovers
- Landmine rotations
- Snatch progression

Shot

- Incline Bench
- Push Press
- Jammer Press

	Phase 2 Increasing force production capabilities		
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Thank you!

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