UKSCA MEMBERS NEWS BULLETIN:

No 2: Dec 2005

Editorial:

It's that time of year again, when we reflect on what has been, look forward to what will be, and wonder how we can keep our athletes away from the mince pies! The past year has been a monumental one in the development of the United Kingdom Strength & Conditioning Association as we continue to go from strength to stronger (excuse the pun!).

This year has seen the Inaugural (independent, following on from 4 years of successful symposium in Scotland, led by Dougie Bryce and colleagues from sportscotland) conference of the UKSCA, which was held at Loughborough in May in partnership with the English Institute of Sport. This had a wealth of recognised international leaders in their fields (Mike Stone, Rob Newton, Deitar Schmidtbleicher), as well as the first opportunity for many to hear Dave Reddin speak about his work with the World Cup winning England Rugby team, and many practical workshops from professionals working within the UK. Excitingly, this event was attended by over 300 delegates, which bodes well for the future of the profession within the UK, and proved to be a forum for much valuable debate and professional development. Personally, think that such opportunities to discuss and debate training philosophies and practices in an informal setting is one of the biggest personal development opportunities that we can have, and I always look forward to such stimulating opportunities at every such event I attend. Planning for the 2006 event is well under way, led by Marco Cardinale, with full details of the dates and venue being released into the new year.

The membership structure of the organisation, defined by the accreditation process, has been fully implemented this year, with 28 accredited members from 57 people who have gone through the process (with a further 19 who passed the practical and knowledge components but haven't sent in forms and supporting information) after the process was ratified in March this year (which also saw our assessor workforce being trained into the role). Dates and opportunities for accreditation in 2006 are published within this newsletter, which might appeal to the current 192 Associate members of the organisation, which we are looking to continuously expand.
As one of the people fortunate enough to be involved in driving the accreditation forward, I know that this developments really marks the opportunity for the UK to have a quality assurance methodology for accrediting strength and conditioning coaches that is world-leading: This is because of the emphasis on competence in coaching (ability to deliver evidence based coaching: Walking the walk) rather than knowledge of (talk the talk) accreditations, that exist in other organisations throughout the world. The development of this accreditation in partnership with the home nation institutes and some key governing bodies (such as the RFU & the LTA), under the umbrella guidance of Uksport, is a key theme that will underpin the future success of the UKSCA, and it is a partnership of which the organisation is very proud.

As well as this newsletter, (another continuing example of how we are looking to expand communication with the key people in the organisation: You, the membership), we have also responded to requests from members for education opportunities: The first members workshop for developing competencies in weight lifting technique coaching was successful run earlier this month at Bisham Abbey, with 16 delegates experiencing the 2-day delivery. Several workshops for people working within the TASS (Talented Athletes Support Scheme, which requires coaches delivering within this scheme to be accredited by the UKSCA within a year) have also been run, at both Bisham Abbey and St Mary's University. More of these workshops will be run in future months, delivered by tutors who will be both accredited members and qualified tutors through the national scheme for coach-educators in sport: The UKSCA remains dedicated to quality of experience for its members. If you are interested in such workshop opportunities, please keep your eyes on the website, where details will be advertised as the workshops become available. Initial feedback to the organisation from these workshops has been very positive:

- Weekend was really informative and well structured – Thanks
- Good pace – clear and precise coaching
- Attention to detail excellent – reasons why even better

Copyright UKSCA 2005

- Excellent instruction – facilities - environments
- Info via demos – top notch!
- Good to breakdown movements – good development exercises/progressions
- Practical course structure was excellent
- Just a few lines so say a BIG THANKS for arranging for me to attend the weekend at Bisham Abbey. Fun, informative and inspiring stuff!

Within this edition, there are several exciting articles that will appeal to all members, regardless of what stage they are at in their strength and conditioning career. We have 2 papers looking at very different aspects of strength and conditioning: Alan Sinclair looks at the concept of pre-habilitation in relation to knee injuries in females, and Dan Cleather looks at a topic very close to many of our hearts: The often mis-understood concept of specificity of training, and it's relationship to the all-important effects of transferring the benefits of training to sports performance. Graham Turner begins his series of interviews with UK strength & conditioning professionals by talking to Tommy Yule (EIS, Sheffield) about his career development to date. This column may prove invaluable to many who are seeking to progress to a full-time strength & conditioning position, and looking for tips as to how this might be achieved. The round-table challenge continues with 4 coaches looking at how they incorporate plyometrics into their programme design, Ian Jeffreys explores the role of strength and conditioning in relation to academies development in his ongoing look at strength and conditioning in schools and colleges, and Stuart Yule dissects the stiff-leg deadlift, a core exercise to many, if not all, strength and conditioning programmes.

The final thing that it is my pleasure to do, on behalf of all of the UKSCA Directors, staff and newsletter column editors, is to wish to all a very merry Christmas, and a very happy, successful and enjoyable new year, in which I would continue to encourage you to engage with us and keep guiding your association forward.

Clive Brewer
Director: Membership Services

CONTENTS

Page 1-2	Editorial, Clive Brewer, UKSCA Director Membership Services
Page 3-8	ACL Injury Prevention in female Athletes, Alan Sinclair, Scottish Institute of Sport Strength & Conditioning Coach, Tayside & Fife.
Page 9	UKSCA Update
Page 10-12	Strength and Conditioning: What is Specificity?, Dan Cleather, S&C Coach, English Institute of Sport (St. Mary's University, London Region)
Page 13-14	Profile of a Strength and Conditioning Coach: Tommy Yule (Yorkshire Regional S&C Lead for the EIS)
Page 15-16	A perspective on…Plyometrics
Page 18-21	Developing a Strength and Conditioning Based Sports Academy – The Cougar Power Model. Ian Jeffreys (UKSCA Director & Director of Athletics and Athletic Performance at Coleg Powys, Brecon, Wales)
Page 22-25	Exercise of the month: Stiff leg deadlift. Stuart Yule, Strength & Conditioning Coach, Scottish Institute of Sport (West region)

Copyright UKSCA 2005

ACL Injury Prevention in female Athletes:

Alan Sinclair:
Scottish Institute of Sport Strength & Conditioning Coach, Tayside & Fife.

Key Points:

- ACL rupture is a serious injury requiring approximately 9 months rehabilitation post surgery.
- Women are 5 to 7 times more likely than men to suffer non-contact ACL rupture.
- At this point, it appears that differences in neuromuscular recruitment patterns between men and women is a key modifiable factor related to increased injury risk in female athletes.
- Specific neuromuscular training programmes have resulted in decreased incidence of ACL ruptures of up to 88% being reported in the literature.
- Training programmes should incorporate: Balance training (including unanticipated perturbations); landing drills, plyometrics and speed and agility drills.
- Interventions must be integrated into an athlete's regular training programme, and must be properly coached and supervised in order to be effective.

Incidence and Impact:
Anterior Cruciate ligament (ACL) injuries in team sports such as basketball, football and hockey are costly, relatively common and require up to 9 months of intensive rehabilitation post-surgery (Boden et al. 2000). In particular, female athletes are 5-7 times more likely to suffer from a non-contact ACL rupture than males (Myklebust et al. 1997). Moreover, only 75% of athletes who have had an ACL reconstruction return to their previous activity levels, and varying degrees of disability are reported (Padra, 2004). This article will focus on (i) the mechanisms behind the increased risk of this injury in female athletes (ii) The efficacy of training interventions designed to reduce the risk of this career threatening injury. Finally, practical applications regarding addressing the issue of ACL injury prevention within Strength and Conditioning programme design and implementation will be discussed.

Mechanism of Injury:
Non-contact ACL injuries usually occur during deceleration and change of direction with the foot planted (McNair et al 1990), and it appears that the ligament is particularly vulnerable when this happens at the end range of knee extension. This combined with increased valgus and tibial rotation appears to predispose females to ACL injury (Nagano et al. 2005). An important point to emerge from a study which reviewed video evidence of ACL injuries happening, was that the vast majority of athletes were close to an opponent at the time (Boden et al. 2000). The authors of this study speculate that unanticipated actions as a result of the opponent may have contributed to the injury by disrupting the injured athletes coordination pattern.

Risk Factors in Female Athletes:
Hormonal Factors: Several theories have been proposed in attempt to explain the increased incidence of ACL ruptures in female athletes. Several authors suggest that hormonal factors, specifically a rise in estrogen during the ovulatory phase of the menstrual cycle, may predispose women to ACL rupture by increasing ligament laxity and impairing fine motor control (Lui et al, 1997; Posthuma et al 1987). However, research that has investigated ACL injury in relation to a specific phase of the menstrual cycle remains equivocal. Moreover, research that has documented ACL injury incidence over time has found no relationship between the phase of the menstrual cycle and injury incidence (Myklebust et al. 2003).

Anatomical Factors: Differences in intrercondylar notch with between males and females has been proposed as a possible contributing anatomical factor in the aetiology of ACL rupture (Norwood & Cross, 1977). However, subsequent research has failed to detect any significant difference between males and females between the width of the intrercondylar notch and the cross sectional area of the ACL (Anderson & Dome, 1999), and the theoretical biomechanical basis for the impact of this factor on the mechanism of ACL injury has also been questioned (Boden et al. 2000).

The intrinsic biomechanics of the female skeleton – a wider pelvis and greater

Copyright UKSCA 2005

Q-angle – increases valgus stress at the knee, and this has also been proposed as a possible contributing factor in ACL injury in females.

Neuromuscular Factors: Although hormonal and anatomical factors may theoretically contribute to increase injury risk in females, they are not subject to modification. Hence, much of the recent research in this area has focussed on differences in neuromuscular recruitment patterns between males and females, and the impact these have on knee stability and injury risk. A key factor in enhancing functional knee stability is the recruitment pattern and relative strength and power of the quadriceps and hamstring muscle groups. The quadriceps are often classified as an ACL antagonist (Boden et al. 2000) as contraction of this muscle group tends to cause anterior translation of the tibia on the femur, increasing the shear force the ACL has to cope with. Conversely, the hamstring muscle group has the opposite effect at the knee joint. Thus, given the increased valgus forces females have to cope with due to the greater Q-angle, any strength imbalance relative to the quadriceps, excessive hamstring flexibility or impaired recruitment of the hamstrings may contribute to the higher incidence of ACL injury in females.

In a recent study, Ford et. Al (2004) studied gender differences in the kinematics of unanticipated cutting in young athletes. The noted that females exhibited greater knee valgus angles compared to males and speculated that this may be a key contributing factor to female ACL injury. Huston and Wojtys (1996) compared neuromuscular recruitment patterns to anterior tibial translation in male and female athletes. These authors noted that the relative recruitment of their hamstrings compared to quadriceps was less in female athletes, and, importantly, that the activation of their hamstrings in response to tibial translation was delayed compared to males.

The impact of Neuromuscular training Interventions on ACL Injury risk:
Given the emerging importance of neuromuscular factors as a key contributing factor to female ACL injury, there has been considerable research interest in examining whether the risk of injury can be reduced via neuromuscular training interventions.

Women's handball has received considerable research attention due to its particularly high incidence of ACL injuries. Myklebust et al. (2003) investigated the effectiveness of an ACL injury prevention programme (roprioception exercises, landing and movement drills) in 850 elite Norwegian female handball players studied over 3 seasons (Div I-III). Season 1 served as a control and in season 2 and 3, players completed three 15 minute sessions per-week. Three key facts emerged from this study. Firstly, there was a significant reduction in ACL injuries as a result of the training intervention. However, this effect was only noted in elite (Division 1) players. Finally, when the players were instructed to carry out the programme unsupervised in the subsequent year, injury rates returned to previous levels. This final point has important implications for the Strength and Conditioning coach in the implementation of injury prevention strategies.

Recently, several studies have investigated the effectiveness of plyometric and agility training on ACL injury incidence. Knobloch et al. (2005) studied the effectiveness of a proprioceptive and coordination training intervention in 24 elite female football players. The first half of the season served as a control, and the training intervention was implemented during the winter break and continued for the second half of the season. There was a significant reduction in all muscular injuries leading to missed training time, and the number of ACL injuries decrease from 2 to zero.

Further evidence for the effectiveness of neuromuscular training interventions comes from the work of Mandelbaum et al. (2005). This was a large-scale study of female football players conducted over 2 years. The study compared a traditional warm up with a specific neuromuscular training intervention that consisted of education, stretching, strength training, plyometrics and sport-specific agility drills. This programme resulted in a decreased incidence of ACL injury of 88% and 74 % in the experimental group for seasons 1 and 2 respectively compared to the control group.

Some insight into the underpinning mechanisms responsible for these impressive results can be seen in the work of Myer et al. (2005), who noted decreased valgus and varus torques following a neuromuscular training intervention which consisted of strength training with free weights, plyometrics; landing drills and sport specific agility training. However, as this above study utilised a comprehensive training programme, it is difficult to delineate the relative importance of each of the individual elements of the training intervention. In a separate study, Myer et al. (2005b) examined the separate effects of plyometric and dynamic stabilization exercises on the kinematics of landing from either a vertical jump or a medial drop landing, and noted that each had a specific

Copyright UKSCA 2005

effect in modulating injury risk. Both methods reduced initial contact time, maximum hip abduction angle and maximum ankle eversion angle. However, plyometric training increased initial knee flexion and knee valgus during the landing phase of the vertical jump, whereas balance training increased maximal knee flexion during the medial drop landing. Moreover, recent research also highlights the importance of including unanticipated perturbations in balance exercises in enhancing neuromuscular stabilization of the knee in females (Hurd et al. 2004).

In summary, neuromuscular training interventions appear to have a significant potential to reduce ACL injury rates in female games players. The protective effect is likely to be via one or more of the following mechanisms: Increased hamstring activation relative to the quadriceps; increased knee flexion during cutting and landing movements, and finally, reduced knee valgus and tibial rotation during landing and cutting movements.

Practical Applications:

Perusal of the scientific literature on this issue highlights several key guidelines for the design and implementation of training interventions designed to reduce ACL injury risk:

- Hamstring strengthening exercises such as stiff-legged deadlifts and Russian hamstring curls (see photo 1) should be routinely included in strength and conditioning programmes for female athletes.
- Current research findings suggest the importance of including plyometric exercises, sport-specific movement and agility drills, and dynamic stabilization exercises which include unanticipated perturbations of balance.
- As training time is often limited, it is a good idea to modify existing warm-up activities to include activities aimed at injury prevention. Examples of warm ups for both sport specific and gym based sessions can be seen in tables 1 and 2 below.
- Coaching and supervision of warm-up activities are essential to the success of the training intervention.
- Specifically, athletes need to be coached in relation to 2 key points during these sessions:
    1. Correct alignment between the ankle, knee and hip (see photo 2) avoiding excessive valgus and tibial rotation (see photos 3 & 4). Athletes should be instructed to ‘stick the landing’ for 3 seconds and self-check for correct alignment.
    2. Ensure adequate knee flexion during landing and cutting movements. A useful coaching cue in this regard is to instruct athletes to be as ‘light as a feather’ when they land.

Photo 1: Russian Hamstring Curls



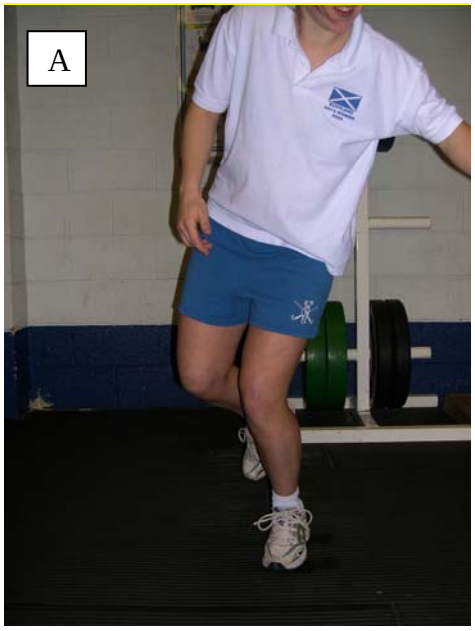
Copyright UKSCA 2005

Photo 2: Correct alignment between the ankle, knee and hip

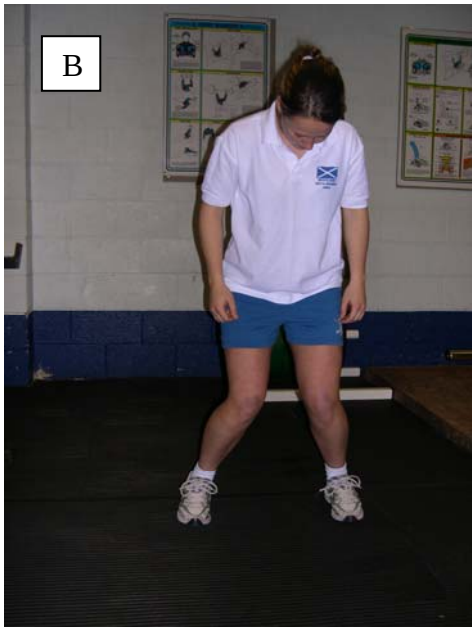


Correct Landing Mechanics:
Knees bent to absorb impact.
Correct ankle knee & hip alignment.

Photo 3: Avoiding excessive valgus (A) and tibial (B) rotation



Excessive Valgus.
'Upper body rotation



Excessive Valgus.
Stiff'knees.

Copyright UKSCA 2005

Table 1 – Example Warm up for Strength and Power Training Session:

	Exercise:	Reps:	Progressions:
General:	Squats	10	
	Back Slaps	10	
	Butt Kicks	10	
	Lunges	10	
Jumping & Landing Drills:	Drop and land (from bench)	10	
	180 degree jump	5 each direction	
	Lateral hop and hold	10 each leg	- Onto unstable surface
	¼ squat jumps in place	3x5	
Proprioception:	BOSU Squat and balance	2x10	1- Eyes Closed - Unanticipated perturbations.
	Forward hop and hold	10 each leg	- Onto unstable surface
	Lunge onto stability disc	5 each leg	- Increase speed
	Standing single leg balance	2x30 secs. Each leg	1- On Unstable surface - Unanticipated perturbations.

Table 2 – Example Warm up for Pitch based session:

	Content:	Notes:
CV Warm up:	2-3 laps of pitch increasing from 50-80% pace.	-
Dynamic Flexibility:	10 squats	-
	25m walking lunges	-
	10 X Leg raises each leg – front	-
Footwork Drills:	2x25m side shuffle	• Low stance with Hips back; • Ankle; knee & hip in line on drive leg.
	1x25m Icky shuffle fwd.	• Load the drive leg.
	1x25m Icky shuffle back.	• Load the drive leg.
	1x25m butt kicks	• 'Fast flicks'
Plyometrics/Landing drills	10 x fwd & backward hop over line each leg	• 'Shock absorber' • 'light as a feather' on landing. • Knee; hip and ankle alignment on landing. • **Stick the landing for 3 seconds.**
	6 x quarter squat jumps	
	10 x lateral hop over line each leg	
	25m 'speed skating'	
Speed and Agility:	6 x 5m cut left/right (3 each direction)	• Line foot up to drive on turn. • Keep bend in knee and keep knee aligned over ankle joint.
	2 x 25m sprint-25m backpedal	• Backpedal – land on toes; keep knees slightly bent at all times.
High Intensity Endurance warm up:	1-2 sets of 4x25m shuttle.	• High Intensity.

Copyright UKSCA 2005

Acknowledgements:
A note of thanks to Fiona Shanks, Head Physiotherapist for the Scottish Institute of Sport, and Dr Brian Walker. Medical Director of the Scottish Institute of Sport for reviewing this article.

References:

Anderson AF, Dome DC (1999) Correlation of anthropomorphic measurements, strength, ACL size and intercondylar notch morphology to gender in ACL tears. *Presented at the annual meeting of the American Orthopaedic Society of Sports Medicine*, June 19-22, Traverse City, MI

Boden, B.P.,Griffin, LY; Garret, WE (2000) Eitiology and Prevention of Non-contact ACL Injury *The Physician and Sports Medicine* 28:4

Ford, KR; Myer, GD; Toms, HE; Hewett, TE (2004) Gender Differences in the Kinematics of Unanticiaoted Cutting in Young Athletes *Med. Sci. Sp. Ex.* 37(1): 124-129

Hurd, WJ; Chmielewski, TL; Snyder-Mackler, L (2005) Perturbation-enhanced neuromuscular training alters muscle activity in female athletes. *Knee Surg Sports. Traumatol. Arthros.* Epub ahead of print, June 2005.

Huston LJ, Wojtys EM (1996) Neuromuscular performance characteristics in elite female athletes. *Am. J Sports Med*. 24(4):427-436

Knobloch, K; Martin-Schmidt, S; Gosling, T; Jagodzinski, M; Zeichen, J; Krettek, C (2005) Prospective Proprioceotive and coordinative traibuing for injury prevention in elite female soccer. *Sportverletz Sportschaden* 19(3): 123-9

Liu SH, Al-Shaikh RA, Panossian V, et al (1997): Estrogen affects the cellular metabolism of the anterior cruciate ligament: a potential explanation for female athletic injury. *Am J Sports Med* 25(5):704-709

McNair PJ, Marshall RN, Matheson JA(1990) Important features associated with acute anterior cruciate ligament injury. *NZ Med J* 103(901):537-539

Norwood LA Jr, Cross MJ (1977) The intercondylar shelf and the anterior cruciate ligament. *Am. J Sports Med* 5(4):171-176

Mandelbaum, BR; Silvers, HJ; Watanabe, DS; Knarr, JF; Thomas, SD; Griffin, LY; Kirkendall, DT; & Garrett, W Jr. (2005) Effectivness if a neuromuscular and proprioceptive training programme in preventing anterior cruciate ligament injuries in female athletes: 2 year follow up. *Am. J. Sp. Med.* 33(7).

Myer, GD; Ford, KR; Palumbo, JP; Hewett, TE (2005) Neuromuscular Training Improves performance and lower extremity biomechanics in Female Athletes. *Journal of Strength and Conditioning Research* 19(1):51-60

Myer, GD; Ford, KR; McLean, SG & Hewett, TE (2005b) The effects of plyometric versus dynamic stabilization and balance training on Lower Extremity Biomechanics. *Am J. Sp. Med.* Nov. Epub ahead of print Nov 2005).

Myklebst, G., Engebretsen L, Braekken I.H., Skjolberg A, Olsen, O.E., Bahr, R (2003) Prevention of Anterior Cruciate Ligament Injuries in Female Team handball Players: A Prospective Intervention Study Over Three Seasons *Clinical Journal of Sports Medicine* 13:71-78.

Nagano, Y. Ida, H. & Fukubayashi (2005) Sex Differences During Landing and Training Effect *British Journal of Sports Medicine (Abstract)*

Posthuma BW, Bass MJ, Bull SB, et al (1987): Detecting changes in functional ability in women with premenstrual syndrome. *Am J Obstet Gynecol*;156(2):275-278

Call for articles:

Alan has kindly agreed to edit this column for the newsletter: We welcome as many contributions for such lead articles from different authors as possible within the membership of the UKSCA. All such material should be submitted to Alan by the author at the following email address:

alan.sinclair@sisport.com

Copyright UKSCA 2005

In Pictures…

Photos from the first weightlifting workshop for UKSCA members, run at Bisham Abbey on the 10-11 December:
The workshop focused on gaining an understanding of the role of Olympic weight lifting in relation to training for sports performance, technique development in the Squat, Snatch, Clean and overhead lifts (presses & jerks) (and derivatives of all of these lifts), coaching methods, fault identification & correction, and basic programming.







This workshop will also be run on 11/12 February 2006 and more dates throughout 2006 – see website for more details and booking

UKSCA Accreditation Dates for 2006:

Date:	Venue:
04 December 2005	Bisham Abbey
21 January 2006	Stirling
04 March 2006	Loughborough
15 June 2006	UWIC, Cardiff
17 September 2006	Bisham Abbey
09 December 2006	Dundee

Please see the website for details about how to register for any of these events:

Copyright UKSCA 2005

Strength and Conditioning: What is Specificity?

Dan Cleather
Strength & Conditioning Coach, English Institute of Sport (St. Mary's University, London Region)

The principle of specificity is one of the least well-understood concepts in strength and conditioning. Broadly, the principle of specificity states that any training conducted by an athlete should be specific to their sport. This maxim should be interpreted in a general sense. All sports require an athlete to have a number of qualities to be successful (for example, skill, speed or strength). Therefore, any activity that improves a quality that is necessary for a given sport is specific to that sport. Where the confusion lies, is in the fact that the term sport-specific is sometimes interpreted too narrowly. For example, some coaches may advocate training that replicates a particular movement pattern evidenced in their sport, only use training modes that emphasize the prevalent energy systems in a sport or utilize training philosophies that mirror those of the sport. Of course, this approach is not inherently flawed – the fault lies when training is restricted only to activities defined by such a narrow definition of sports specificity.

No matter what approach a strength and conditioning coach takes to training his or her athletes, ultimately the defining philosophy of his or her system is that it is impossible (or at least not efficient) to get in the best possible shape for a sport simply by participating in that sport. If this was not the case then strength and conditioning would be obsolete and athletes would train solely in their sport. Generally, after an athlete has reached a certain level of cardiovascular fitness, strength, speed, etc, by playing their sport they cannot make further improvements simply through continued participation in their sport. Instead to make further gains they need to seek other training modalities that allow them to further challenge their physiological system and hence make continued improvements. This is analogous to the principle of progressive overload .

It is important, therefore, to distinguish between playing and practicing sport skills and strength and conditioning training for a sport. In the former, an athlete is concerned with improving their skill base and becoming better able to use their physical attributes in the competitive environment. In the latter, an athlete is focused on developing their physical attributes in order to be a more commanding physical presence when competing. This distinction is important. The weight room (or track, etc) is not an appropriate place to develop specific sporting skill, and if an athlete needs to improve in this area this should be achieved through increased skill practice. In fact, later we will explore why training activities should not be too movement pattern specific. Instead the weight room should be used for developing physical qualities and general movement skills (Chiu, 2005).

Modern training in sport is generally structured around a periodised plan. Periodisation is the planned progression of an athlete through a series of training cycles with different aims leading to a planned peak in performance at some point in the competitive season (Baechle and Earle, 2000). Classically a periodised plan begins with a period of high volume, low intensity training, and over the course of the season volume is reduced and intensity increased (Baechle and Earle, 2000). The amount of technical practice increases commensurately with the increased intensity. Another way to characterize a periodised plan is by considering it as three phases: a period of general training, a period of specific training and then the competitive season (Yessis, 1982). It is important to note that the success of any periodised plan is, therefore, built upon a foundation of general physical preparedness (GPP). Thus in order to reap the benefits of more specific conditioning and increased technical practice the athlete must first be physically prepared in a general way (with regards to the qualities that are important for success in their sport). If we extend this model to a long-term athlete development plan we can infer that before an athlete can benefit from specific training, they must first become a well-conditioned athlete (Chiu, 2005).

An example of this is the employment of plyometric training in athletics. Many coaches use these more specific tools for the development of explosive power early in the periodised plan before a period of structured strength training. This exposes the athlete to an unnecessary injury risk, as they may not be strong enough to withstand the forces developed. From a performance perspective, plyometrics are most effective when an athlete has developed some strength capabilities, and plyometrics are used to transfer this strength into power. Equally, plyometrics are often used too early in an athlete's long-term development. The NSCA recommends that an athlete should be strong (i.e. generally physically prepared) enough to back squat one and a half times their body weight before commencing a plyometric training programme (Baechle and Earle, 2000).

Thus when we consider sport specific training we must first ask ourselves what general qualities are specific to that sport and to what extent has the athlete trained and developed these qualities?

Copyright UKSCA 2005

In many cases this type of analysis will reveal that the most specific training that that athlete can then do is to train for the improvement of some very general qualities.

We have already defined sport specific training as being focused upon improving the qualities that an athlete needs on the field. In the selection of appropriate training activities we must be careful to ensure that the stimulus prompts adaptations that improve performance on the field. This is the concept of transfer of training. The degree to which a training modality transfers is hard to evaluate, with the gold standard being validation of training protocols in peer reviewed research. For example, there is an abundance of literature that demonstrates that strength training with free weights results in adaptations that transfer to a wealth of sports (Fatouros et al., 2000; Newton and McEvoy, 1994). Not all training modalities have been shown to be as effective, however. For example, preliminary research suggests that some types of core stability training may not be performance enhancing (Tse et al.,2005). Similarly, we need to guard against making intuitive (and possibly erroneous) judgments. For example, does an increase in balance skill on a swiss ball, really translate to improved balance on the rugby field. Balance skills may not be transferable generally, and in this case there are differences between swiss ball activity (where the supporting surface moves) and rugby (where the ground stays still and everything else moves) (Willardson, 2004).

In the selection of appropriate training activities we also need to consider the effectiveness of a training modality. For example, if a rower is training for pressing strength, is a flat bench press or swiss ball dumbbell bench press more appropriate? Although both activities will increase pressing power the flat bench press will allow the athlete to handle a greater load and thus increase pressing power more efficiently. One might argue that the swiss ball version will improve that athlete's balance, but a) will this transfer to the water, and b) is this gain worth the sacrifice of greater strength improvements (Willardson, 2004).

In choosing training activities we also need to appreciate the potential for a negative transfer of training. A negative transfer describes a reduction in sporting performance due to sport specific training. For example, a cricketer who practices bowling with weighted balls in order to improve their "throwing specific strength" may become less accurate – with a consequent decrease in performance. A negative transfer can often arise when a training movement pattern is too similar to the sporting skill. In this case a "pattern confusion" arises – the two motor patterns are too similar and the body's ability to perform the original skill is diminished (Mount, 1996). For this reason it is often useful to choose training activities that are different to the sporting skill. Remember, we train for sporting skill on the field, and use the weight room to improve general skills and physical properties.

Selecting training activities that are different to the sporting skill also introduces variety to the programme. Variety in training is vital in terms of making continuing improvements and preventing overtraining (Yessis, 1981). One of the pitfalls of narrowly defined sport specific training is that the programme becomes based upon improving only one or two components of fitness and this compromises potential gains. For example, if muscular endurance is important to your sport (for example in rowing) a narrow definition of sport specific training might restrict your work in the weight room to specific muscular endurance training. However, there is a strong correlation between maximal strength and muscular endurance (Zatsiorsky, 1995), therefore, muscular endurance can also be improved with maximal strength training. The most efficient training programme may therefore include both of these facets of strength training.

When considering elite athletes, variety in programming becomes critical. These athletes may spend hours each week in very specific training. To continue the rowing example, elite rowers may spend twenty hours a week rowing on the water or ergometer. A narrow definition of sport specific training would suggest that the most specific work these athletes could do in the weight room may be circuit training (which trains the cardiovascular fitness necessary for their sport) or muscular endurance training. However, these athletes are already engaging in this type of activity for hours each week in their training, and the law of diminishing returns suggests that more of this type of work will not improve their fitness noticeably. Conversely, if these athletes engage in strength or power training they may improve dramatically, and these gains could transfer to the boat in terms of improved muscular endurance as a result of increased strength, increased power in each stroke (making the boat travel faster) and improved posture (due to strength and flexibility gains).

When considering specific training it is, therefore, important to have a broad frame of reference and take an holistic view of a training programme. Fitness qualities should not be viewed in isolation. For instance, increased strength may improve an athlete's agility, aerobic training may allow an athlete to reap better returns on their strength training and flexibility training may improve an athlete's power. Most athletes would benefit from becoming more generally athletic.

Copyright UKSCA 2005

Not only will this improve their quality of life, but improvements in overall athletic ability generally transfer well to the sporting context.

A broad philosophy of training may encompass many topics and considerations. For example, the best injury prevention strategy may involve exercises that from a performance perspective cannot be considered to be specific at all. However, being healthy and able to train and compete is clearly the paramount concern of any training programme. The more specifically an athlete is training the more important general training becomes. If an elite rower was to train purely specifically (in the narrow sense of the word) they may only engage in pulling activities. This would result in imbalances in muscular strength across joints due to the pulling musculature being relatively more developed than the pressing musculature.

Finally, in evaluating how specific an exercise or training modality is to a given sport there are a number of considerations. It is common for activities to be considered specific to a sport based purely upon kinematic (i.e. movement) considerations. In evaluating similarities certainly this is one consideration. However, we also need to consider the kinetics (i.e. force, energy and power) of a movement (Chiu, 2005). Similarly, we may need to consider the metabolic or hormonal demands of an activity, the mechanical specificity or the joint angles at which forces are developed (Stone,1982). A detailed evaluation of the similarities between activities is generally quite involved (e.g. Garhammer and Gregor, 1992).

When designing a sport specific training programme it is important to guard against being too specific. The best method of training is not simply to overload the particular movement patterns involved in a sport. If the best way of training an athlete were to replicate their sport in the weight room, then the most efficient training would be to simply participate in their sport. If this were the case, there would be no need for strength and conditioning coaches.

References

Baechle, T. R., & Earle, R. W. (2000). Essentials of strength training and conditioning. Human Kinetics: Champaign, IL.

Chiu, L. (2005). The science of specificity. Presentation given to NSCA conference.

Fatouros, I. G., Jamurtas, A. Z., Leontsini, D., Taxildaris, K., Aggelousis, N., Kostopoulos, N., & Buckenmeyer, P. (2000). Evaluation of plyometric exercise training, weight training and their combination on vertical jumping performance and leg strength. *Journal of Strength and Conditioning Research, 14,* 470-476.

Garhammer, J., & Gregor, R. (1992). Propulsive forces as a function of intensity for weightlifting and vertical jumping. *Journal of Applied Sport Science Research, 6(3),* 129-134.

Newton, R. U., & McEvoy, K. I. (1994). Baseball throwing velocity: A comparison of medicine ball training and weight training. *Journal of Strength and Conditioning Research, 8,* 198-203.

Mount, J. (1996). Effect of practice of a throwing skill in one body position on performance of the skill in an alternate position. *Perceptual and Motor Skills, 83,* 723-732.

Stone, M. (1982). Strength training modes free weight: Part II: Considerations in gaining a strength-power training effect (machines vs free weights). *National Strength Coaches Association Journal, 4(1),* 22-24.

Tse, M. A., McManus, A. M. & Masters, R. S. W. (2005). Development and validation of a core endurance intervention program: Implications for performance in college-aged rowers. *Journal of Strength and Conditioning Research, 19,* 574-552.

Willardson, J. M. (2004). The effectiveness of resistance exercises performed on unstable equipment. *Strength and Conditioning Journal, 26(5),* 70–74.

Yessis, M. (1981). The key to strength development: Variety. *National Strength Coaches Association Journal, 3(3),* 32-34.

Yessis, M. (1982). The role of all round, general physical preparation in the multiyear and yearly training programs. *National Strength Coaches Association Journal, 4(5),* 48-50.

Zatsiorsky, V. (1995). Science and practice of strength training. Human Kinetics: Champaign, IL.

Copyright UKSCA 2005

Profile of a Strength and Conditioning Coach

Graham Turner (UKSCA Assessor & former Director, who works at Leeds Metropolitan University) conducts an interview with **Tommy Yule** (Yorkshire Regional S&C Lead for the EIS)

Tommy, prior to becoming a coach you were a Weight Lifter yourself. How were you first introduced to the sport?

My father competed in Olympic Weightlifting. He represented Scotland at the 1974 Commonwealth Games. He would train at home, in the garage, so my brother and I would join him with some general training from a young age and this evolved into Olympic weightlifting

How instrumental was your father's involvement in your development?

Extremely instrumental. Without him I would probably have not even done the sport. Also with his experience and knowledge he ensured the appropriate development over the years that allowed me to reach the standard that enabled me to compete at a high level.

Was it an advantage to also have your twin brother involved in the sport with you?

It has been a big advantage. I always had a training partner as a kid. Now I have someone who understands me and can provide appropriate guidance.

What was your most notable achievement as a junior?

I would say finishing 5th at the European juniors when I was 19….Snatched 150kg and C&J 187.5kg at a body weight of 97kg

The Commonwealth Games in Kuala Lumpar in 1998 was a highlight of your career. What are your memories of the event?

I would say that what I remember the most is the excellent preparation I had leading up to the event and the excitement and anticipation I had being at my first major multi sport event.

In the 2002 Commonwealth Games in Manchester you medalled again? Can you tell us about the experience?

I had a lot of injury trouble during and after the 2000 Olympics. So I basically only had about 6 months of good preparation for these Commonwealth Games. During the time I was injured I lost up to 20kg of bodyweight so I moved down a body weight category. At the games I competed in the 94kg class and I snatched 157.5 kg to win the bronze. I would say that that was the best snatch I had ever done, even though I had snatched 165kg in the past, given my strength levels and my lower bodyweight

How are preparations going for The Commonwealth Games in Australia next year?

They are going well at the moment. I had a hip operation last October, so I was basically starting again with respect to my preparation for the next Commonwealth Games. My first competition this year I did 110kg Snatch and 140kg C&J and I did 143 Snatch and 178C&J last month at the Commonwealth Championships to finish 4th. So I am making the required progress in order to achieve a good result next year.

Who is the coach who has had the biggest influence upon your development and what have you learned from him or her?

I don't think there is one person. Over the years there have been many individuals that contributed. First is my father, then there was a couple of coaches (Rhodri Thomas, Andrew Saxton) and then my brother. Being involved in the sport, just talking to other lifters about what they have done has helped a lot. Giles Greenwood (Gold medallist from Manchester) is an example of someone who has offered a lot, he understood himself and how he ended up snatching 180kg. Many lifters just train and when they stop making progress, they don't understand how they reached a certain standard so have no idea how to progress further. This didn't happen to Giles and he can effectively communicate his experiences to others. Also reading literature from the old

Copyright UKSCA 2005

Soviet Union (Verkoshanski, Roman, IWF handbooks etc) has contributed a lot of my underpinning knowledge

How did the transition from competing to coaching begin?

In the gyms I've trained in from the age of 18 there has always either been other athletes or lifters training, so it started by simply informally helping others out in the gym. This would involve many aspects of coaching including organising training, technical development and general support as an athlete attempts to progress into the unknown. When I was a biomechanics research assistant I got the opportunity to formally provide S&C support to athletes from a number of sports and then a few years after that I had the opportunity to apply for my current role as a S&C coach for the EIS

Can you tell us about your current coaching position and what it involves?

I am currently a Regional S&C Lead for the EIS. I am basically responsible for the delivery of S&C services to world-class funded athletes in Yorkshire.

Describe a day in the life of a Strength & Conditioning Coach

The day would start about 8:30am where I would check e-mails and respond to any correspondence. Then before athletes would start coming in for morning sessions there may be training programs to write or follow up further with communications with coaches or athletes. I would then be in the gym or on the track for a few hours coaching athletes. After lunch I could have a meeting to deal with regional operational issues or with another service provider to discuss certain athletes. I would probably be in the gym again for a few hours until then end of the day at 5:00pm

What would be top of your wish list to help you improve the way that you do your job?

Highly educated, bright coaches and talented, motivated athletes. I feel that if the coach or athlete does not understand their training and what is actually necessary for continual progressions in their sporting performance then it makes a S&C coach's job very difficult. I question how effective and productive I am being toward performance if the rest of the athlete's program is sub standard

The UK Strength and Conditioning Association is now in its second year of existence. What has been your involvement to date?

I was involved in consultation as a BWLA rep before the UKSCA was set up. I have undertaken Level Three assessment to gain Accredited status and have now also contributed to a couple of items for the newsletter

How do you see the Association evolving?

I think it will continue to grow and as it continues to find its feet it will understand further what needs to be in place to ensure that S&C coaches are developing in a manner that ensure they are effective in sport

What advice would you give to an aspiring Strength and Conditioning Coach?

Continually develop your scientific knowledge to understand physical development. Additionally, seek opportunities to experience and understand physical development and sporting performance. Question and review everything that you do so that you know how to change training based on observed results in training and in sporting performance. Also, look at other coaches and/or S&C coaches programs and understand why they may have produced good results. Take any opportunity that is given to you to work with athletes, whatever their sport or level, to gain as much experience as possible. Finally, keep an open mind.

Copyright UKSCA 2005

A perspective on…Plyometrics

Column Editor: Clive Brewer
(UKSCA Director, National Lead for Athlete Development, sportscotland)

This column has been designed as a challenge to strength & conditioning professionals to put down their thoughts on certain topics that can be compared by the readers to the thoughts of other professionals. The aim of this snap-shot approach is to help to clarify the diversity of opinion (in some areas) for readers, or strengthen the consensus of opinion amongst the professionals in other areas. Typically this is how we as a profession, or as individual practitioners, evolve our thoughts: By making informed decisions on what we do in practice and being able to justify such decisions with evidence based information.
The challenge that I will set to practitioners every edition is to respond to a discussion topic in less than 250 words! Strictly 250 words! Any more than this and they have been told it will be edited out.
This is a way of stimulating interest in topic areas that may need further investigation in more detail in later articles / editions. Contributors have been asked to respond honestly and openly, without attempting to ask others views on this before submitting a response. The idea is for these 250 words to reflect their own professional practice:
I would also like to, at this stage, acknowledge the generosity of these professionals in freely and voluntarily contributing their knowledge to this discussion, and I hope that I can rely on them, and many others amongst the readership, to contribute to future columns.
The title of this editions discussion is:

How I integrate plyometrics into my training programme design:

Gil Stevenson:
Chairperson, UKSCA; Scottish Institute of Sport Network S&C Coach; Head Coach, Scottish National Women's Rugby Team.

It really is not all that surprising that hops, skips, jumps and bounds are effective training strategies since sports activities consist of exactly these types of movements.
As a boy practicing gymnastics I am pretty sure our coaches had not heard of 'plyometrics' but our training routines were certainly plyometric in nature.
Accepting that plyometric activities will have a performance enhancing effect the trick for the coach is to identify how best to integrate them safely into training programmes to ensure optimal effect.
A principles and practices that guide my practice, based upon evidential & experiential knowledge, are as follows:

- Low impact plyometrics work well as warm-up activities.
- Integrating plyometrics with heavy weight lifting and explosive weight lifting in a complex training format is extremely effective.
- Upper body plyometrics including 'jumping' press-ups and medicine throws provide opportunities to simultaneously develop mid section strength and sports specific speed-strength.
- High impact plyometrics are very demanding on the musculo-skeletal system and should be applied with care and for very specific purposes at limited specific times in an athlete's programme.
- For the same reason athletes need to be strong enough to allow them to perform high impact plyometrics without breakdown in technique and risk of injury. Therefore the development of maximal strength and strength –speed through weight lifting are necessary pre-requisites.
- Plyometric activities tend to be fun to perform and are a welcome source of variety in training sessions.

Jez Green
Formerly with the LTA, now an Independent strength & Conditioning professional with bases in the UK & the USA working with International tennis players

In tennis the use of plyometric training centres around three areas:

- Storage and release of elastic energy between the back swing and forward swing of stroke
- Leg drive into the strokes

Copyright UKSCA 2005

- Development of the crucial “first step”.

In the back swing of the stroke the large force-producing muscle groups ie latissimus dorsi and pectoralis, are pre-stretched to a maximum. These muscles are then in an ideal position to quickly apply force in the forward swing. Recovery of this stored elastic energy needs to occur rapidly to benefit stroke production: Throwing medicine balls to replicate tennis strokes is a very effective training tool to simulate this.

The vital “first step” of movement around the court also utilises this “stretch – shortening” cycle. After a split-step a player’s knees will flex then extend quickly to store and recover elastic energy. This maximises lower leg drive when accelerating to a ball. Drop sprints where a player drops from a low box and immediately accelerates in different directions is a very effective training method for this move.

Lastly, the vertical linear momentum of the leg drive up into the strokes created by ground force is also dependent on an effective “stretch – shortening” cycle. The maximising of these ground forces allow a player to drive upward and forward to a ball thus providing velocity and spin to the shot. Clean and snatch mechanics replicate this move.

Raphael Brandon:
EIS Strength & Conditioning Coach, London Region

The first consideration is to identify which type of Stretch Shortening Cycle contraction needs to be developed – fast (100-200 msec) or slow (>250 msec). For fast SSC I recommend starting with hopping movements – tuck jumps, hurdle and lateral hops – performed in sets of 10. Begin with 50 contacts in total, progressing to 100. Once the athlete is developing some ‘bounce’, drop jumps can be introduced using a box height relevant to their strength. Starting with 3 x 5 and progressing to 3- 5 x 10. I recommend using two boxes to avoid lactate accumulation from the step-ups between jumps. For slow SSC, I recommend vertical jumps and double footed horizontal jumps, using sets of 5-10 reps for a total of 50 contacts. Progressing to 100 contacts. If both fast and slow SSC are required then a combination of the above and multi-directional movements can be used. Volume of sessions is always monitored by foot contacts. I tend to programme distinct plyometric workouts, sometimes occurring prior to speed or speed endurance sessions and use complex jumping exercises in weights sessions only during peaking or competition phases. Freshness is a key a consideration in terms of when the workout occurs in the microcycle, as is strict attention to sufficient rest periods between sets – 3-5 minutes for drop jumps and 1-3 minutes for hops and vertical jumps- lactate accumulation most be avoided for optimum fast twitch fiber recruitment.

Mike Favre
Strength & Conditioning Coach, US Olympic Centre, Colorado Springs

Plyometrics are a valuable tool in the development of my athletes here at the US Olympic Training Centre. Plyometrics play their biggest role during the competition preparation phases. This not only increases speed and power but enhances the transfer from weight room to competitive arena as well. This isn’t the only time that plyometrics are included in my programs; I cycle them in periodically throughout the year depending upon the training emphasis. My track cyclists tend to have their plyometrics concentrated during their competition preparation periods when emphasis is on power and speed production. These plyometrics may be executed by themselves are in conjunction with another exercise as in “complex training.” An example of “complex training” could be back squats followed by tuck jumps.

My Greco-roman wrestlers on the other hand, have one day per week devoted to plyometric type training. Due to the surface they wrestle on they don’t get much in the way of plyometric work during their practice. Their schedule tends to be two traditional lifting days with one plyometric day sandwiched in between them. This training can consist of everything from jumps to medicine ball exercises as well as some wrestling specific exercises. The wrestling specific exercises have plyometric qualities as well such as dummy throws. Over the past 5 months this schedule has resulted increases in performance in both the weight room and competitive arena.

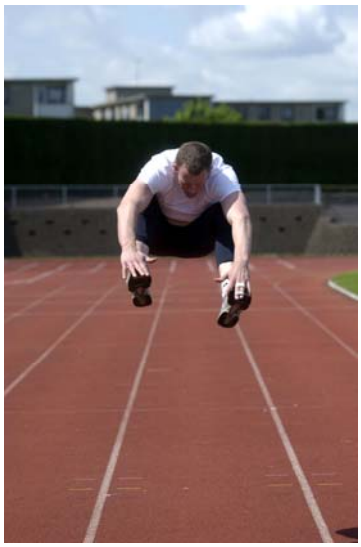
In summary:

It would seem that there is a general consensus amongst our contributors that:

- Static stretching plays a valuable part in performance preparation, with an increased emphasis on this modality during specific competition preparation phases
- Plyometrics training is developmentally progressive: i.e. it builds upon an already developed strength base in an athlete
- There is considerable support for utilising complex training methodologies that sequence plyometrics after maximal strength exercises, in order to gain maximal potentiation of motor units and Type IIx muscle fibres.
- Plyometrics offers opportunities for high-level variation to be introduced into training, with specific modalities matching specific training objectives.



Sarah Borwell (GB Tennis Player) undertakes medicine ball plyometric training against a medicine ball wall in the gym at the All-England lawn tennis club during the 2005 Wimbledon championships



Simple exercises such as a maximum jump with a tuck or a pike (illustrated) move can form easy and effective exercises to integrate into a complex (maximal strength exercise: 2 –3 minutes recovery: Plyometric exercise)

Photos are from " strength & conditioning for games players" (2005) and © The national coaching foundation, published with the permission of Coachwise publishers, who supply a variety of resources for coaches: www.1st4sport.com

Thought of the month:

Comes from Member Brian Hamill, in a letter to the UKSCA which responds to Ian Jeffrey's column in the last edition of the newsletter, supporting the inadequacies of strength & conditioning provision within UK Schools:

"One core problem in Britain is the confusion of sport with recreation / leisure. Sport requires a particular approach to strength & power, differing from current fashion in the leisure industry and many educational establishments. We must all learn to differentiate and emphasise the difference"

Brian, we couldn't agree with you more!

Copyright UKSCA 2005

Developing a Strength and Conditioning Based Sports Academy – The Cougar Power Model.

Ian Jeffreys (UKSCA Director & Director of Athletics and Athletic Performance at Coleg Powys, Brecon, Wales).

Article Outline

This article highlights the key role of a systematic strength and conditioning programme in any sports academy and proceeds to outline a current system that could provide a model for the development of a strength and conditioning based sports academy.

Main article

A current trend in many Further Education Colleges in the UK is the development of sports academies, and the marketing of these as the way for potential athletes to enhance their performance. Whilst many of these provide excellent sport specific coaching, few address the vital issue of strength and conditioning, and even fewer have a systematic strength and conditioning programme in place to optimise performance enhancement. In the majority of sports offered by these academies, athletes can never wish to maximise their performance levels without a well designed strength and conditioning programme. Without this in place, the Academies are short changing their performers, and it could be argued that a strength and conditioning programme, delivered by an accredited strength and conditioning coach should be a pre-requisite for any establishment holding the title Academy.

The Performance Director and Performance Programme

As Director of Athletics and Athletic Performance at Coleg Powys I have been in the fortunate position of being able to build our sports academy from scratch. Central to this development has been the development of a strength and conditioning programme – Cougar Power, around which all the sport specific academies are built. This position means that I am responsible for the programming, scheduling and regulation of all teams, and work with the team coaches to ensure that the development programme is optimally utilised. This is unlike the position in many Colleges, where individual sports academies are established, each with their own separate programmes, coaches etc. By building the academy around a strength and conditioning programme it allows a long term development system to be established, which then directs the operation of each and every sport programme. By having a person responsible for all athletic programmes, it allows for optimisation of each programme, and also allows the Performance Director to control match commitments, regulate training volumes etc across all athletic programmes. It also ensures that each programme makes the optimal use of the strength and conditioning coaches within the academy. Since its inception, Cougar Power has since become the flagship of all of our Athletic Programme, and has been very successful in developing the conditioning of all our athletic teams and also our individual performers. As all athletes, regardless of their sport are able to access the performance enhancement programme they are all subjected to a strength and conditioning programme designed to enhance their long term development. This has enabled us to cater for athletes from minority sports, as well as from traditional mainstream sports, in the knowledge that each student athletes is developing the required fitness parameters for their sport in a system that optimises the long term development of these parameters.

The Mission and philosophies

Our mission is to provide each and every student athlete with a world-class development programme that optimises their long-term development, and utilises the most efficacious training methods and systems. Whilst appearing grandiose, this mission provides all of our staff with a clear indication of what we are trying to achieve, and ensures that our programme is always attempting to move forward in terms of facilities, equipment, methods and systems, in an attempt to stay true to our mission. In addition we have a number of key philosophies that guide our developments and programmes, these include training movements not muscles, free weights based exercises, grooving foundation locomotive movements etc. Via this mission all coaches are aware of what we are trying to achieve, and the philosophies outline the methods we use to achieve the mission. This helps guide both the long term planning and the day to day running of the Academy.

Copyright UKSCA 2005

The Development Programme.

The system that we employ is based around a three-year development programme, with each year having specific aims in terms of strength and conditioning. The system employs a development pyramid, (see figure 1) with each year corresponding to a level on the pyramid. Each level has a number of specific aims, each corresponding to a key aspect of the athletes' long-term development. Unlike many "peak by Saturday and every Saturday after that" type programmes, the long-term development of the athlete is put ahead of short-term performance measures.

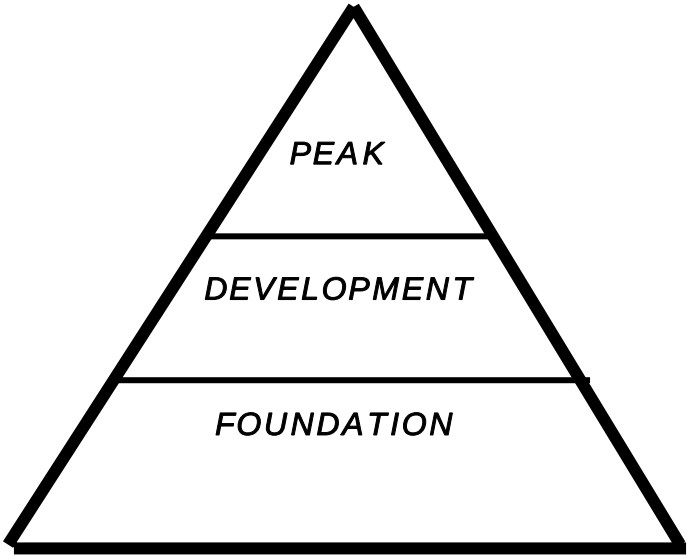


Figure 1: The development pyramid

This long-term development is highlighted by the fact that it is only in year three that most athletes are undertaking the type of periodised programme that involves any real peak. This is optimally effective at this stage as they have the required strength and conditioning fundamentals to enable them to optimally use the higher intensity raining methods required at this peak stage. In reality, due to the type of courses that our student athletes undertake many leave after two years, but despite the fact that they never reach our peak cycle, they leave with the fundamentals that allow then to enter any HE programme, and immediately undertake the training required to reach optimal performance.

Macrocycle and Mesocycle distribution

Each year at the Academy represents one Macrocycle of training, and each macrocycle has specific aims and objectives. The macrocycle is then divided into six mesocycles, which correspond to each term of training, with the holiday periods used as transition cycles to provide for active rest between each mesocycle. Each mesocycle has its own specific aims and objectives, to enable the overall macrocycle aims to be achieved. For example mesocycle one of the foundation level is termed prehab, and looks to develop appropriate muscle activation patterns, movement patterns and body related strength. This phase allows us to ensure that the athlete has the required strength, movement and stability to enable them to minimise injury risks and optimise performance when they enter the weights room in mesocycle 2. Within the whole foundation level, the aim is to teach fundamentals and overall body strength and stability. Each exercise and movement has a teaching progression associated with it, that allows us to optimally progress the movement through the phase, ensuring that future developments are founded on effectively grooved movement patterns.

Whilst variation in training is built into the programmes, the first two years of training are built around long term development models rather that on traditional periodised schedules. As highlighted earlier, it is only in the peak phase that periodised systems, aimed at peaks in performance are utilised. This long-term development allow us to effectively achieve the quality and quantity of training required to enhance the athletes

Copyright UKSCA 2005

overall development, without being sidetracked by short-term performance requirements.

Macrocycle 1 THE FOUNDATION LEVEL

Aim To ensure that the students' athlete has the required motor patterns to enable them to perform optimally in their sport and to enhance their performance and reduce injury risk during future stages of the performance programme.

Objectives
To optimise muscle activation patterns and balance
To groove the key locomotive movement patterns
To develop a sound base of strength and stability
To ensure sound technique in key strength training activities
To ensure the athletes has a sufficient endurance base for their sport.

Macrocycle 2 THE DEVELOPMENT LEVEL

Aim To develop the key fitness parameters of the athlete's sport to a level where they can undertake advanced peaking based programmes.

Objectives
To challenge the key locomotive movement patterns until they stand up to open sport specific challenges.
To develop a high degree of overall balanced strength, and stability in all of the key movement patterns.
To develop a high degree of sport specific endurance.
To develop an appropriate muscle mass for their sport.
To ensure all athletes have excellent grooved techniques on key strength training exercises.

Macrocycle 3 THE PEAK LEVEL

Aim To optimise performance in sport

Objectives
To develop a high degree of sport specific strength and power
To optimise sport related movement.
To enable the athlete to perform for the duration of their game through specific metabolic conditioning.

Weekly and Daily Schedule

In terms of the weekly schedule, we use the first hour in the morning (9.00-10.00) of each day for conditioning, and at this time athletes will attend their own timetabled session. Each athlete has their own programme, that relates to their sport and their stage of development, all built into the Performance Pyramid and its macro and mesocycle plans. At this time there are running based sessions, weights room based sessions and general conditioning sessions. All of these are delivered by strength and conditioning specialists, and are written in accordance to the programme aims and philosophies. Following these sessions the student athletes are then encouraged to employ our performance nutrition and recovery guidelines through the day. They then undertake their academic classes before team practices are held in late afternoon after the completion of the classes. Competitive fixtures are held on Wednesday afternoon, and teams or athletes not competing will train on the Wednesday morning.

Athlete Development Programme

Another key elements of the programme is the classroom based Athlete Development Programme (ADP). This is aimed at empowering our student athletes to optimise their performance via a planned educational programme. This addresses the "whys" of the S&C programme to enable the athlete to comprehend the aims of each aspect of the S&C programme, which facilitates the motivation to carry it out. This explanation of the purpose of each drill and exercise is expanded to each and every session so that the student athlete understands the purpose of each and every thing that they do in any session. The ADP also addresses vital development issues such as recovery, lifestyle, nutrition, psychology, goal setting, performance reviews etc. Our athletes are

Copyright UKSCA 2005

required to log each and every session they undertake, which assists in motivation and also provides a record of their overall progress through the programme.

Performance testing

Each athlete is tested on a battery of tests four times per year, in September, December, March and June, and these provide both us, and the athlete, with evidence of the progress they are making. The results consistently demonstrate that our athletes make gains throughout the three-year cycle, and whilst the emphasis has always been on the development of the individual, our sports teams have enjoyed great success, much of it as a result of the conditioning programme.

Summer programmes

A challenge to our development programme comes in the summer, where our athletes are spread over a wide geographical area. At this point, the importance of our ADP comes in, as our athletes understand the how's and why's of programme design, and are able to undertake the programme that we write for them during this period. Additionally, we open up the weights room for a time each day, via a staff rota to enable athletes who wish to train at our facility to undertake their sessions.

This programme, has been very successful in terms of enhancing athlete performance, and provides a suitable model for the utilisation of a strength and conditioning programme as the foundation for an athletic programme. Whilst providing for a potential model for development, the programme is always considered a model in development. As new research comes online we always try to ensure that the programmes we utilise employ the methods that allow us to optimise athlete development, whilst still staying true to our key mission and philosophies.

A follow on thought…





Because of it's contribution to strength, speed, power and flexibility, with huge transfer of training benefits to sports performance, the development of strength and conditioning technique in pre-elite athletes is vital in underpinning high performance development within the UK: This is being reflected within the National-Regional Academy programme emerging in Scotland & the TASS schemes in England & Wales: "The Talented Athlete Scholarship Scheme, or TASS as it is better known, is a Government funded programme that awards Scholarships and Bursaries to talented athletes that are committed to combining their sport and education. It aims to reduce the drop out of talented athletes from sport and supports and develops the talent of today for sporting success in the future: **Coaches delivering on the TASS programme need to be UKSCA Accredited by September 2006.**

Copyright UKSCA 2005

Exercise of the month: Stiff leg deadlift

Stuart Yule
Strength & Conditioning Coach, Scottish Institute of Sport (West region)

Leading on from the first 'exercise of the month' article, the focus for this article will remain in the lower extremities and shall concentrate on the stiff leg deadlift (SLDL).

The rationale for the inclusion of the stiff leg deadlift in an exercise programme is twofold. Firstly, it is a major developer of the legs, hips and spinal musculature and secondly, it can be used as a progression in the teaching of more advanced lifts such as the clean and snatch.

A commonly used term for the SLDL, particularly in the USA, is the Romanian deadlift (RDL). Occasionally the SLDL is referred to as a straight leg deadlift; however for the purpose of this article the SLDL will be more closely related to the RDL.

Overview

The SLDL is a hip extensor exercise.

The table below highlights the key muscles that are used in the correct execution of the SLDL and the muscle action.

MUSCLES	ACTION
Erector spinae	Keeps spine locked in a neutral position throughout exercise
Gluteus maximus	Extends hip
Hamstrings (bicep femoris, semitendinosus, semimembranosus	Extends hip

Abdominal muscles will be activated during the SLDL, to aid in the stabilisation of the spinal column.

Copyright UKSCA 2005

Exercise technique

POSITION	Description	Problems	Variations/ solutions
START (figure 1)	Hands evenly space just wider than shoulder width		Could adopt wide (snatch) grip
	Bar is held at arms length just below waist.		
	Stand in an erect position lumbar and thoracic spine extended	Athlete has thoracic kyphosis.	Assess ability to extend thoracic spine without bar. Possibly seek physiotherapy intervention
	Feet hip width apart		
	Toes forward or slightly angled out		
	Breath is taken in prior to descent and held		
DESCENT (figure 2)	Knees are slightly unlocked to approx 15-20^0.		
	Hips are flexed and move back		
	Spine is locked and movement created through rotation about the hip	Inability to keep spine locked. Lumbar and thoracic spine flex (figure 3)	Assess ability to extend/flex spine (happy/angry cat). Assess hip flexor mobility (straight leg raise)
	Centre of mass moves to back of foot	Centre of mass moves to front of foot.	Practice with back facing wall about 1 foot length away and teach athlete to push hips back till rear touches wall and weight is through heels.
	Shoulders move in front of bar	Bar remains in line with bar	Check knees are not flexing on descent.
	Bar remains close to thighs	Bar drifts way from body	Check weight is through rear of foot and shoulders are in front of bar.
	Descent ends at point just prior to when lumbar spine flexes, normally just below knees (figure 4)	Hamstring flexibility	Descend where athlete's mobility allows and progress over time.
ASCENT	Described spinal posture remains intact	Spine flexes	Check load is not too heavy for athlete
	Hips are extended through driving hips forwards		
	Motion continues until bar is back to start position		
	Just below mid thigh breath is slowly released		

Figure 1. Start



Figure 2. Decent



Copyright UKSCA 2005

Figure 3. End of Decent



Figure 4. Wrong posture



Figure. 5 Teaching



TECHNICAL ISSUES

Table 2 highlights the procedure for executing a safe and effective SLDL.

Through practical experience, the primary technical fault that arises, is the athlete's inability to maintain the correct spinal posture. The spine must remain locked ensuring that the neutral lumbar lordosis remains intact throughout the exercise. As a consequence the risk of disk herniation and ligamentous damage is eliminated. Correct technique will result in an increased muscle activation of the spinal extensors resulting in a posterior shear force. When the spine is flexed the spinal extensors lose their oblique line of action, therefore unable to resist the shear forces produced from the exercise, therefore, over time, the risk of injury to discs and spinal ligaments increases. (McGill, 2002)

In order to avoid spinal flexion correct instruction must be given. The most common method adopted in the gym is using a stick to align the spine and to give feedback to athlete (figure 5). The stick is aligned down the spine and contact must be maintained throughout.

It is important that the athlete focuses on their hip extensors to create the movement as this focus will facilitate their learning and the transfer to their sporting performance. The load should be adjusted so that this can be the focus and the spinal musculature remains as a spinal column stabiliser.

Copyright UKSCA 2005

APPLICATION

From the previous sections it is clear that the SLDL can be used as an effective exercise to strengthen the hip extensor musculature. Hip extension has a major role in all dynamic activities and sports. The hamstrings cross the hip and the knee; however they are very often only strengthened through knee flexion exercises. This however does not replicate sporting activity, where the hamstring must exert forces to extend the hip particularly in jumping and running. This SLDL can therefore be an excellent exercise to strengthen the hip for dynamic sporting activities.
Other possible sporting situations that perhaps warrant the prescription of the SLDL during preparatory parts of year are as follows:

Hockey- The position a player adopts during a penalty corner requires strength through hip extensors to control position and allow effective power production to shot.

Judo/wrestling- Techniques that require hip power and strength through hip extension. Strength through hip and spinal extensors to maintain their desired posture prior to attack.

Swimming- Power through hips at start and turns.

Rugby- Front row forwards; must maintain neutral spine whilst exerting force through hip extensors while scrummaging.

Sailing- ability to extend around and flex around hip whilst maintain neutral spine.

The SLDL is also an excellent tool to us when teaching and strengthening a clean or snatch, as it teaches the correct back, hip, knee and shoulder alignment as the bar passes the knee.
Figures 6 and 7 demonstrate the mid point of the pull during the snatch. Notice the positions are the same as the end position for a SLDL.

Figure 6



Figure 7



CONCLUSION

This article has given an overview of the SLDL. The loads should be progressed and as with any lift, limited by the weakest link in the kinetic chain, very often the lumbar spine. Its correct implementation and execution is vital, if the desired training effects are to be observed, whether this is strength or technical development.

REFERENCES

McGill, S. **Low Back Disorders, Evidence-Based Prevention and Rehabilitation**. Human Kinetics, 2002.

Kendal, F et al. **Muscles, Testing and Function**. 4th Edition, Williams and Wilkins, 1993

Copyright UKSCA 2005