THE 24TH ANNUAL INTERNATIONAL SYMPOSIUM ON BIOMECHANICS IN SPORTS

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The annual conference of the International Society of Biomechanics in Sports (ISBS) was this year hosted in the beautiful setting of Salzburg in Austria. Having attended the conference last year in Beijing, China I was hugely looking forward to a conference which very successfully combines presentations of the latest in biomechanics research with very enjoyable social events.

This year, the conference was comprised of 7 keynote lectures, 22 applied symposia lectures, 140 oral presentations and 105 poster presentations. This year keynote lectures were delivered by: Darren Stefanyshyn, Jan Cabri, Alberto Minetti, Felix Eckstein, Vasilios Baltzopoulos, Bruce Elliot and Joseph Hamill. Joseph Hamill of the University of Massachusetts was honored by the society this year with the prestigious Jeffrey Dyson award. His detailed presentation outlined the role of complex biomechanical analyses in understanding the mechanism of injury in overuse running injuries.

This year the structure of the conference was a little different to that in Beijing last year. This year along with the usual keynote lectures, there were also a number of applied symposia where invited speakers were afforded opportunities to discuss their specific research interest in a dedicated, specialized symposium. For example, there were applied symposia on skiing, footwear, tennis, football (soccer) and strength training.

Obviously that of strength training warranted specific attention from me. Two presentations here were of particular interest and these will be discussed briefly in this article.

The first was by Dietmar Schmidtbleicher who also chaired the strength training symposium. Dr. Schmidtbleicher is a world-renowned German researcher who has published a huge body of work in the area of training and adaptation in strength and power sports, periodization, the stretch shortening cycle, vibration training and plyometrics. Here he presented some data from a recent research project he has conducted and also discussed training for power in the context of this current research and his entire body of research.

The data he presented was from a study which examined the effects of strength training and jump training on jumping performance. The vertical jump is often used a measure of an individual's power production capabilities (Carlock, 2004). In Schmidtbleicher's study there were three experimental groups and one inactive control group. Group 1 trained exclusively with jump training, practicing vertical countermovement jumps a number of times per week. Group 2 strength trained. They performed heavy squats a number of times per week. Group 3 did a combined training program which involved both heavy squatting and countermovement jump training. There was strong control between groups for training frequency and training

volume. Subjects were tested before and after their training intervention in the squat jump (a purely concentric jumping action – it utilizes no stretch shortening cycle) and a countermovement jump.

All three groups significantly increased jumping performance (in both squat and countermovement jumps) in comparison to the control group. Interestingly, the strength training group increased jumping performance more than the jump training group by ~3-4% (although not significantly so). Importantly, the combined training program increased jumping performance to a significantly greater extent than the isolated jump training. Schmidtbleicher suggests this data is strong evidence which demonstrates the key role maximal strength plays in dynamic power production. This role is graphically represented in figure 1. Schmidtbleicher suggests that an increase in maximal strength will result in an increase to power and athletes' rates of force development.

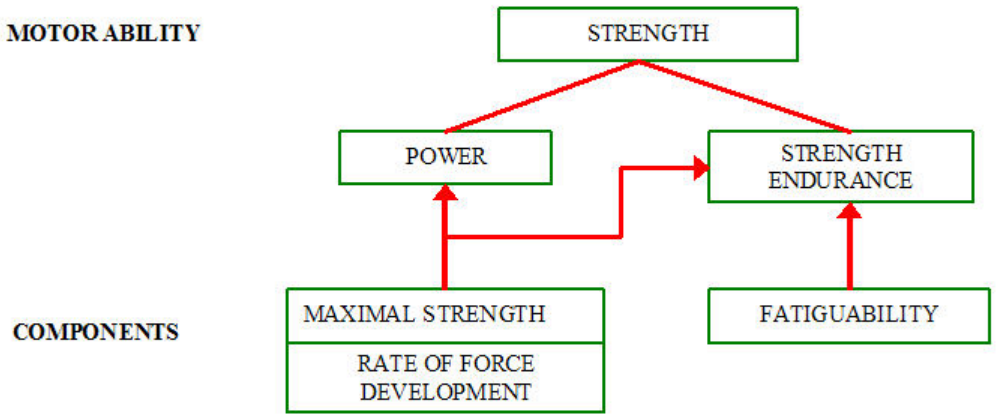

Figure 1: Schematic representation of the relationship between strength, power and rate of force development. (Schmidtbleicher, 2006; ISBS Symposium)

Drawing on some of his previous research Schmidtbleicher also discussed possible methods of periodization for athletes involved in training for power sports. He suggested an undulating method of periodization is most effective. His past research has suggested that this approach is more effective than traditional training blocks or "macro-cycles". More information regarding undulating periodization can be found here. One example of such a training cycle would be to train for maximal strength on a Monday, to train fast stretch shortening cycle (SSC) activities on a Wednesday and to train slow SSC activities on a Friday. Training for hypertrophy could also be included into such a weekly training plan depending on the athlete's specific needs. Examples of a slow SSC activity would be countermovement jumps. Fast SSC activities have much faster transition times between the eccentric and concentric components. A plyometric drop jump is an example of a fast SSC action. Schmidtbleicher emphasized that slow and fast SSC activities are very different movements and involve very different neural activation patterns. From a standpoint of specificity he even went as far to say that training in slow SSC activities will not significantly accrue benefit in fast SSC ability, and vice versa.

Schmidtbleicher regards drop jumps and other fast stretch shortening cycle activities as essential to the training preparation of the speed/power athlete. He stressed however that drop jumping activities must be optimized to ensure their effectiveness. This is done primarily by optimizing the drop height. Too great a dropping height can increase the eccentric loading beyond the reactive strength capabilities of the athlete, while too small a drop height may not encourage a prestretch sufficient enough to maximally augment the concentric portion of the jumping action. The appropriate drop height to perform drop jumps from can be optimized through analyzing the height to which athletes jump to and their ground contact times during drop jumps from varying heights.

Also, to increase the fast SSC capabilities of the athlete Schmidtbleicher highly recommends performing these exercises in a completely non-fatigued condition. For this reason, while strength and jump training can be incorporated into the same training week, they should not be combined in the same training session. He recommends that a drop jump training session could include approximately 3-5 sets of 8-12 drop jumps. To ensure fatigue does not develop and the quality of exercise performance is high he recommends as much as 8 seconds recovery between jumps and 10 minutes recovery between sets.

Another interesting presentation during the strength training symposium was that by Carson Patterson from the University of Innsbruck. He investigated the possibility of utilizing weighted vertical countermovement and squat jumps as a replacement exercise for cleans in power athletes. The clean offers a very effective non-specific method to assist athletes in developing power output capabilities (Hydock, 2001; Hori, 2005). When performed correctly there is strong kinematic similarities in hip and knee extension observed during the clean (or power cleans) and vertical jumping (Hori, 2005). Research has shown that performance in the vertical jump is strongly correlated to performance in power dependent sports (Sawyer 2002). However the effectiveness of the clean in a power training program can be limited by the technical proficiency of the lifter (Hydock, 2001; Hori, 2005). Poor technical efficiency can limit the transfer of power production in the clean to specific sports events. Examples of poor technical proficiency which would limit transfer to sports would be poor positioning through the second pull, a lack of utilization of the “double knee bend” (Hydock, 2001) or a failure to reach full extension at the knees and hips. Therefore, it is questionable as to whether the clean should be used in the training programs of athletes who struggle to learn the appropriate technique.

The research presented by Patterson demonstrated that the power produced in weighted vertical jumps can be comparable or even greater than that produced by technically proficient lifters in the clean. This suggests that the weighted jumps might be a suitable, technically simpler exercise to replace the clean for those athletes who have problems learning the clean successfully.

In this research study the experimenters utilized a rigged safety apparatus which winched the weighted barbell up off the athletes’ shoulders after the peak of the vertical jump. This way the athletes did not land with the weight on their back which eliminated any dangerous impact loadings on the lumbar region or on the knee joints upon landing. Future research needs to examine the amount of weight that can be safely utilized in this exercise for athletes who do not have availability to such an apparatus.

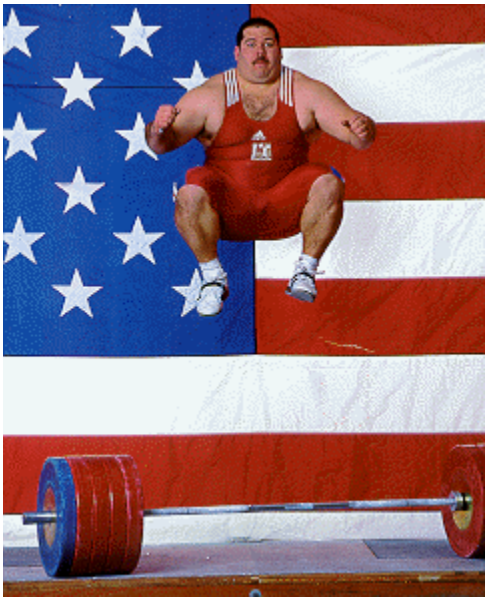

Figure 2: Shane Hamman

The ISBS' 24th annual International Symposium on Biomechanics in Sports was very well organized and a fantastic success. The conference closed with the announcement that Seoul, Korea would be the hosts of the 2008 Symposium. It had previously been decided that the 2007 event would be hosted in Ouro Preto, Brazil. This will be the first time that the conference will be hosted in Latin America, further enhancing the internationalization of the society and the symposium.

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