

RESEARCH-SUPPORTED SPORT CONDITIONING



IN AN ATHLETE'S MOST CRITICAL COMPETITION, they never magically rise to the occasion; rather they sink to the level of their training. To be at the top of their game requires much more than traditional measures of fitness. Competitive athletes must train beyond the basic fitness principles by improving explosive power, multi-joint strength, speed, agility, quickness, deceleration, movement skills, rotary power, balance, and reaction skills. These physical attributes are optimally trained and expressed on the playing field when athletes can link their mind with their muscles to have powerful, efficient execution of movement patterns. A shift to this style of training is well received by sport participants who enjoy exercising more athletically. The kinaesthetic experience better matches sport demands – it intuitively makes sense to athletes.

Training the secondary fitness characteristics in an athletic model also has utility for adult clients. Fitness facilities such as Curves and Healthy Inspirations do a tremendous job getting people active who may feel uncomfortable or unprepared to join other more mainstream health clubs. Sport conditioning is at the other end of the continuum, serving those desiring to graduate from the traditional focus on primary fitness characteristics, linear cardio and muscle building isolation strength. It is for the niche of clients who actually enjoy working hard and being challenged to physically handle the drills, both from a whole body coordination and intensity perspective. It is not for the LSD (long slow distance) crowd or those who dislike exercise and only wish for an easy quick fix.

Or, in some instances, perhaps it is. If their avoidance of exercise stems from disliking the effort, then sport conditioning is not for them, as it requires extra physical coordination and mental concentration. But if their dissatisfaction with exercise stems from being bored with their workout, sport conditioning may be for them. Importantly, the exercise style provides a kinaesthetic experience and mental requirement that holds people's interest throughout an entire workout.

The neurologically challenging exercise inventory comes with a high metabolic cost and higher muscle activation levels, so the caloric output and exertion levels meet basic fitness goals. The exercise curriculum can be drawn upon to increase muscle mass, elevate strength outputs, drive up anaerobic capacity, improve balance and whole body reaction skills, refine movement skills and prevent injury.

Science was slow to validate sport conditioning prescriptions – academia prefers focused isolation studies that are easier to accurately measure and consistently replicate protocols for, subject to subject and study to study. The scientific study design and process is designed to produce valid and reliable results, and isolation studies best lend themselves to that process. Moreover, sport scientists and their graduate students are more familiar with traditional fitness measures, so tend to study what they know.

Fortunately, as sport scientists, exercise physiologists and active researchers, we are able to liaise with peers who are engaged in functionally oriented research studies. Additionally, related fields produce research that can be considered when examining the many ingredients that comprise a sport conditioning paradigm. It is important to anchor practical methods to science that helps validate the results purported from coaching and athlete experience.

With the ever-growing popularity of functional training, more researchers in the sport science field have recently been compelled to test the accuracy of the training results. The focus of a functional training paradigm should involve the key components organised under the pillars of strength, balance and movement.

Strength

Typically traditional strength training philosophies have been centered on single joint isolated movements, which target individual muscle groups. The results from strength training in isolation may leave an athlete susceptible to injury through muscle imbalances, restricted range of motion, and poor stabilising muscles. This style of training does little to aid the everyday function of an athlete.

Proper strength training requires one to build core strength and stability around all the body's joints to enable full function for the demands of sport and everyday life. In almost every sport athletes are required to link rapid movement patterns through the kinetic chain while applying force, such as when tackling an opponent or during a spike (attack hit) in volleyball. Due to the need for such precise movement sequences and force production it is essential the athlete trains to maximise these skills.

More recently many trainers, coaches, and teachers have moved from traditional strength training to a more functional approach, termed Linked System™ approach at Twist Conditioning. Exercises set up as closed kinetic chain become linked by focusing on a complete toe-to-fingertip sequence. This approach links movement patterns with muscular contractions, working along the kinetic chain for the generation of power. Similarly, the whole body works across joints to load muscles when acting as decelerators. With this ever-growing interest in functional training, there has been a growth in research supporting it.

What the research says

Numerous studies have examined the effects of Linked System™ training and its relationship with rehabilitation and athletic performance. A study performed by Blackburn and Morrissey (1998) examined the relationship between Open Kinetic Chain (OKC) and Closed Kinetic Chain (CKC) resistance exercises in female athletes. Participants were split into two groups. Group 1 performed knee extensor exercises (OKC) and Group 2 performed the squat exercise (CKC). Participant's movement patterns were captured using motion analysis and compared to each participants movement patterns during a vertical jump and standing long jump. Results showed that the CKC squat exercise was correlated to the joint movements seen during the vertical jump and long jump, whereas those that performed the OKC knee extensions showed no correlation in joint movement patterns, thus linking CKC exercises to functional movement patterns.

To compare the effects of a CKC versus an OKC resistance training program, a study performed by Augustsson et al., in 1998, compared the effects of a 6 week OKC or CKC program to the pre-and post test performance of a weighted squat exercise and a vertical jump. Those that participated in the CKC training group had an increase in the resistance they were able to squat (31 per cent) as well as an increase in vertical jump performance (10 per cent) whereas the OKC group showed a 10 per cent increase for squat performance and no increase in the vertical jump. Researchers attributed the changes to the neurological training benefits derived from CKC training.

Balance

Athletes should always be prepared to meet the demands of their sport, being able to read and react in an environment of organised chaos. An athlete's balance is constantly challenged as they are knocked off balance by an opponent during a game, or as they transition their weight from one foot to the other during movement.



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If you examine the movements required of an athlete you will find that they spend very little time on two feet and within their base of support. An athlete is constantly challenging his or her balance by placing their body weight and force production outside of their base of support – therefore balance is essential in their success. Balance requires the integration of anticipatory and reflexive actions driven by the sensory systems within the body (proprioception, vestibular and vision). The goal of training on unstable surfaces is to improve the neuromuscular feedback within the CNS, increasing the sensitivity of the feedback pathways. Balance training has become popular in the fitness industry, and can also be used in strength programs by training up weak links in the body, establishing a kinetic chain more capable of handling lifts of increased load and complexity on stable surfaces.

What the research says

Balance training has been praised for its rehabilitative qualities in relation to the ageing population and more recently in the prevention of injury and increased athletic performance. In regards to injury prevention a study performed by Malliou et al. (2004), investigated the effects that a two-week balance-training program had on injury prevention for female soccer players. The overall results showed a significant decrease in lower limb injuries throughout the season.

To assess the performance measures with balance training, we can look at a recent study performed by Heitkamp et al. (2001), who examined the effects that a 6-week balance training program had on knee flexor and extensor strength in comparison to a 6-week resistance training program. Participants in the balance training group performed exercises using a trampoline, stability ball and balance board, whereas the strength-training group performed their training on a leg press and leg curl machine. Each group was pre and post tested for single leg balance, stability on a tilting platform and for isometric strength using an isokinetic device on each lower limb. Both groups showed a gain in muscular strength in each limb, but the balance-training group also displayed a gain in balance and correction in muscular imbalances.

To further explore the effects of balance training on athletic performance we can refer to a study performed by Paterno et al. (2004). Paterno and colleagues found that a 6-week balance training program decreased the incidence of ACL injuries in young female athletes and showed an increase in their postural and single limb stability, which resulted in improved performance.

Movement

Sport requires precise motor skills, in order to link movement skills and sport skill technique in a coordinated pattern. Movement training develops fundamental motor abilities to allow athletes to be more coordinated, precise and skilful at faster speeds. Movement skills training results in a faster, more agile athlete equipped to better react when under pressure. Increased movement skills net economy of movement, so bodies in motion expend less energy during more fluid, optimally executed moves. Speed, agility and quickness are desired outcomes and are achieved by enhancing individual movement skills that are later sequenced together to produce agility patterns. Other muscle and neural adaptations also contribute to acceleration, deceleration, top end speed and first step quickness.

What the research says

Wojtys and colleague (1996) compared the effects of 6 weeks of isokinetic, isontonic and agility training on muscular reaction time during a lower limb perturbation. Results showed that only those that participated in agility training were found to have an improvement in muscle reactivity in the lower limb, indicating the importance of movement training in the improvement of muscular reactivity.

Young et al. (2001) compared the specificity and transferability of sprint and agility training methods during a 6-week training program. Results of the study showed that neither training method had a successful transfer between skills, but resulted in improvement in their direct skill itself. These results support the need for athletes to train specific to the skills of their sport by increasing neuromuscular coordination in order to improve their motor abilities. Improved fitness and linear sprinting alone would not prepare an athlete who faces deceleration, stop and starts and random agility demands.

Functional training has been slowly maturing for years, but recently more literature has become available supporting it. We have several binders packed with research articles from a wide variety of journals in many fields (refer to the reference list below for further study details). You can also source a list of sport conditioning research posted within the 'Education' section of the web site www.sportconditioning.com to access further published papers studying the secondary fitness characteristics. Collectively, the body of evidence supporting functional training and sport conditioning is much deeper today than it was just a few years ago. As fitness professionals we must stay up-to-date with literature and research in order to educate our clients and ourselves. ■

The online version of this article contains references and suggestions for further reading



Peter Twist

Peter's sport conditioning paradigm has been applied to training over 700 pro athletes and authoring 10 books, 18 DVD's and over 400 papers on athlete development. Twist Conditioning Inc delivers functional training and sport conditioning education globally and offers their home study courses in Australia through QPEC (qpec.com.au).



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Brynne attained a Bachelors of Kinesiology from the University College of the Fraser Valley and is currently working towards completing her Masters of Science at the University of British Columbia, where she is studying the physiological effects of balance training. Brynne works within the Education and Certification Division at Twist Conditioning in Canada.



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