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"Transfer: From the Weight Room To The Field"

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Prepare to Perform

Presented by Cato Rutherford

In both individual sessions and throughout the course of a macrocycle we want to obtain an ascending progression of neurological demand (Cormie, 2011).

Pre-session structure

- Target pain pathways and mobilise tissue using manual therapy, self-myofascial release, wrapping, strapping, taping, compression garments (preference is key the athlete is the best judge of what is beneficial). (Beardsley, 2015).

- We can increase range of movement by taking the joint through a full range of motion and using by utilising dynamic/short holds.

- A sport-specific warm-up and muscle activation is important to increase core temp, shunt blood to the periphery and neutrally upregulate (Guissard, 2006).

- Movements with a high level of neurological demand in the final phases of preparation are important: this includes primary lift warmups, plyometric drills or short efforts on field (Saez, 2007).

Done well, this will ensure the best possible quality of movement from the athlete in the session. It will help prevent compensatory movement patterns and increase self-efficacy and mental preparedness pre-session (Harris, 2000).

Every training session must be strategically planned, contributing to one goal: improved sport performance

However, we must remain specific in our training approach

Ensuring specificity requires us to ask…

Does our prescription transfer to sport performance?

This means that properly selecting and periodising the various methods of resistance training is paramount when transferring weight room gains to the sporting arena (Gorostiaga, 2002).

Overarching benefits of the weight-room

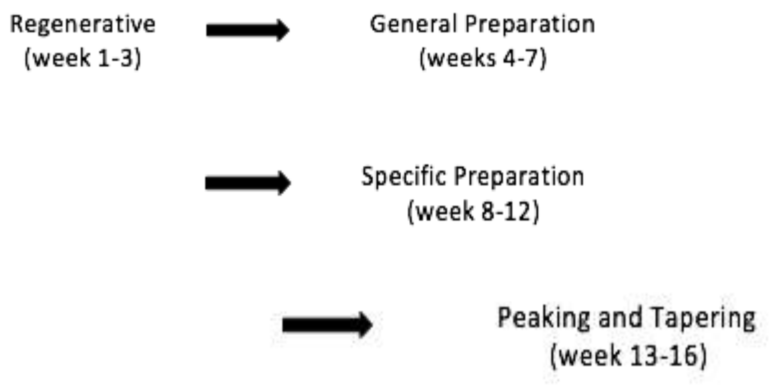
Resistance training enhances performance through a myriad of adaptations:

- Force production
- Rate of Force Production (explosiveness)
- Injury prevention
- Movement efficiency
- Body composition (etc.)

Each phase of training should target these outcomes.

Coaches should then implement phase potentiation, where each training cycle progresses on the previous and supplements the next until optimal fitness is reached (McGuigan, 2012).

An example of a phasic structure is as follows…



So how do we utilise variations of resistance training within this phasic structure?

Let's look at:

1. Isolation: targeting muscle groups and injury prevention.

2. Integration

3. Advanced Power Training Methods

The importance of isolation: use it early on

Isolation is also useful to target muscle groups which otherwise would not be fully stimulated during multi-joint movements and address muscle imbalances (de Franca, 2010).

Muscle imbalances caused by "bilateral deficits" can be resolved using unilateral single-joint exercises. For example, a sprinter utilising a single-leg hip bridge to resolve a bi-lateral differences in glute power output when running (Schoenfeld, 2012).

As for targeting under-active muscles, an example might be utilising an overhead triceps extension to activate the long head of the triceps. That is, for optimal activation of the long-head of triceps, the shoulder needs to be flexed at 180° and the elbow placed through a full range of motion (Lez Bozec, 1980).

Another common example is using the seated calf raise to reduce gastrocnemius involvement (due to the knee bend) and shift the focus on to the soleus muscle. An overpowering gastrocnemius is common in field/court sport athletes, and by effectively developing the soleus muscle athletes can improve sprint and countermovement jump performance (Nagano, 2010).

Isolation also contributes to sport performance by…

- Providing variation and increasing athlete interest
- Prepping the athlete for subsequent training phases
- Targeting muscles through a full range of motion
- Increasing length-tension relationships
- Activating muscles pre-session
- Developing underactive muscle groups
- Neural control

You wouldn't fire a canon from a canoe.

Isolation exercises achieve a stable base from which to build optimal strength and power in the later training phases.

Integration: potentiate earlier phases

Similar to an individual session prep protocol, transitioning from isolation and regenerative phases to more integrative and sport specific phases involves an increase in neurological demand to prime the athlete (Harris, 2000).

Neurological demand is increased by:

- The amount of muscle used (multi-joint)
- The speed of the lift (velocity)
- The neurological co-ordination requirements
- The intensity or load (mechanical tension)

Within an integration phase, force production is addressed first due to the "force vs velocity relationship" as displayed below:

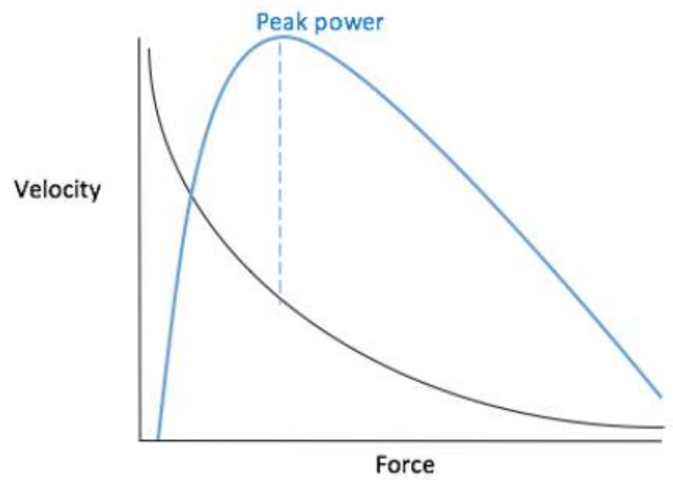


Figure 1.1 (Adapted from Cormie, 2011).

Maximal strength and muscle force production underpin power production. Thus, improving force production will shift the force-velocity curve to the right, meaning force production at any given velocity of muscle shortening will increase and result in increased maximal power (Cormie, 2010).

We need to use heavy, compound and bilateral lifts (e.g. squat, deadlift, bench press, overhead press).

But remember, strength is a skill and these movements must be mastered or else they may negatively impact sport performance (i.e. injury due to improper form when squatting).

An advanced strategy is to incorporate isometric pauses within strength training sessions (Harris, 2000).

Pausing during the eccentric phase of compound lifts leads to:

- Double the neural stimulation of the target fibres
- Increased force production at sport specific joint angles
- Technique proficiency
- Increased mechanical tension and overload

Advanced Power Training

Once we can generate high amounts of force with efficient biomechanics and no injuries, we can optimise power output within a sport specific context.

Research shows that power development is optimised when athletes undergo combined plyometric, power and strength training. This means doing both box jumps, squats AND hang cleans in order to maximise the rate with which force is produced (Cormie, 2011).

We can target these things in the weight room by training:

- Length-tension relationships
- The stretch reflex
- The stretch shortening cycle (SSC)
- Contractile elements

Changing length tension relationships: stretch under load

We can optimise length-tension relationships in the weight-room to enhance sport performance and reduce injury risk.

Pausing at end range of motion under load is particularly beneficial for athletes who require high rate of force production (RDF) AND need to be highly mobile (e.g. hurdlers and gymnasts).

Targeting muscles under a loaded stretch that exceeds resting length and exposing the tissue to eccentric stresses increases reactive strength, joint stability and protects tissue against eccentric forces (a major cause of hamstring tears and rotator cuff injuries) (Aquino, 2010).

Moreover, training at long muscle lengths increases joint-tendon strength and increases maximal muscle contraction force at all joint angles (Schoenfeld, 2010).

For example, lengthening gastrocnemius and pausing at end range of motion during a calf raise increases muscle fibre stretch tolerance and the optimal length of force production.

This in turn allows athletes to produce force at longer muscle lengths, reducing the risk of soft tissue damage under load or during dynamic movement.

Enhancing the stretch reflex

The stretch reflex is the generation of an involuntary muscle contraction as part of the nervous system's response to maintaining muscle length (Gabriel, 2006).

Muscle stretching under load causes mechanical deformation of muscle spindles, leading to a "reflex" mechanism.

This neural response is present when lifting weights, in dynamic movements that involve quick changes of direction (e.g. field sports) and when absorbing ground contact after aerial propulsion.

Plyometric exercises increase muscle energy storage during deceleration and speed of energy release during acceleration, improving stretch reflexes and explosiveness (Newton, 1994).

This includes exercises such as:

- Squat jumps
- Multidirectional non-linear sprint drills
- Depth jumps and countermovement drills.

Enhancing the SSC

The SSC in a nutshell: when a muscle fibre is stimulated, stretched, then immediately shortened, it can harness elastic energy to produce maximal force (Cormie, 2011).

Time available for force development, interaction of contractile and elastic elements (muscle fibres & tendons) and the stretch reflex determine the magnitude and rate of force produced (Bosco, 1982).

Strength training enhances the SCC through neural upregulation, preferential growth of type ll or "fast twitch" muscle fibres and high threshold motor unit development (important for explosiveness on the track) (Komi, 1986).

Incorporating loaded plyometric drills (e.g. trap bar jumps) also enhances the SCC and increases dynamic force production (i.e. accelerating through the end range of motion with load).

Contractile elements: using pins and pauses

What if we can't use elastic energy to help generate force quickly?

We are forced to rely solely on the interaction of muscle fibre myofilaments to produce force without any recoil from the pre-stretch of elastic components (Wilson, 1991).

Sprinting is a good example:

Sprinters use purely concentric force to propel themselves out of the start blocks in response to the gun.

Relying on the elastic stretch response would mean eccentrically lowering their centre of gravity before take-off. The force generated from this approach would not be worth the time trade-off, as it would only slow their reaction to the gun.

Exercises that force the athlete to overcome the inertia of a load without relying on the stretch reflex are beneficial for these types of sporting situations (Izquierdo, 2002).

In the weights room, utilising pin squats or pausing at the very end range of a squat before transitioning to the concentric phase trains the contractile components to overcome a heavy load from the sport-specific joint angle.

In Summary

- There is a phasic structure to both pre-session and long-term training which optimises the transfer of strength training modalities to sport performance.
- Isolation is beneficial early in the training process to assist hypertrophy, add variation and address muscle imbalances.
- Strength training using compound lifts increases force production in athletes.
- Integrative power training potentiates the gains made during strength phases and allows athletes to produce force quickly.
- Specificity will guide exercise prescription and the use of exercise variations within strength training programs.

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