

Exercise progression from a clinical environment to a sporting venue

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Poor body mechanics and / or movement patterns are an underlying cause of many sporting injuries. It is important that athletes maintain and improve their physical competency as they develop physically and mentally. This article outlines the importance of physiotherapists in developing exercises and warm-up regimes that act as stepping stones in improving movement competency while progressing athletes from a clinical to a sporting environment.

LEARNING OUTCOMES

- 1 Understand the importance of correct movement patterns in sport: to prevent injury and enhance performance.
- 2 Appreciate the transference of exercise from a clinical to a sporting environment.
- 3 Identify altered movement patterns which may affect an athlete's sporting performance.
- 4 Understand the physical development of young people.
- 5 Understand the building blocks to improved performance that can be set in place for young athletes.

Injuries will always occur in sport. Some are difficult to prevent, for example being injured in a tackle or hit by a cricket ball. Many, however, can be prevented or at least reduced in frequency and intensity. Often, the underlying cause of these preventable injuries is the athlete's poor body mechanics and / or movement patterns, and the best time to affect this aspect of performance is in the early stages of an athlete's sporting life, whatever level of sport they eventually reach. This is not the prerogative of those trying to attain sporting excellence, but of everyone involved in physical activity (Mountjoy *et al* 2011). A core skill of physiotherapy is the ability to assess movement and to provide exercise programmes to correct

any potential "errors". In recent years, assessment tools have been designed to assist this process (Padua *et al* 2009; Cook 2010), with some being designed for a specific sport (Titleist Performance Institute 2013). All the assessment protocols contain elements of the physical competencies outlined in table 1 and tend to assess similar movements and provide similar answers.

In essence, there is a need to assess the athlete's movement strategies while they are performing tasks which are related to whatever is limiting performance. Is the athlete able to transfer load, i.e. move the appropriate joint in the correct plane, in the correct sequence, at the appropriate movement velocity (Wallace 2015)? The assessment and accompanying exercise programmes are usually undertaken in a clinical environment, or possibly a gym. Without the benefit of seeing patients in their usual sporting environment, we can never be sure that good movement patterns are being transferred to the

athlete's sporting daily life. Of course, these principles can equally be related to the occupational / normal activities of a patient, rather than specifically to an athlete.

Poor physical competency, associated with reduced tissue integrity, frequently leads to compensatory movements, resulting in reduced movement efficiency and effectiveness, delayed skill acquisition, and may lead to injury (Abernethy & Bleakley 2007). It is important to ensure that the athletes maintain and improve their physical competency as they develop both physically and mentally, and that they are not required to perform more complex sporting actions before they have the physical competency required for that skill.

Young athletes do not necessarily have good, or even adequate movement patterns. Although this may be noted by coaches, and may affect the athlete's selection, it is often not picked up by

Posture	→ Static and dynamic. General and sporting
Mobility	→ Joint / muscle / neural. Symmetry
Endurance	→ Cardiorespiratory. Muscular
Strength	→ Agonist : antagonist
Speed / power	→ Acceleration. Deceleration. Controlling eccentric forces
Skill / co-ordination	→ Balance, proprioception, synchronicity / sequencing of movement
Neuromuscular control	→ Static and dynamic
Sports specificity	→ If appropriate

TABLE 1: Physical competencies

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medical personnel until the athlete develops an injury. At this stage, the treating physiotherapist is able to assess, treat and hopefully rectify any movement issues, but as the athlete returns to their sporting environment anything “learnt” in a clinical environment is frequently not carried over into the sporting situation.

Athletes aged 18 or older who develop overuse injuries due to poor movement patterns or poor control can become concerned about having to reduce or stop training. If treatment entails going back to movement basics in terms of how a skill is executed, the rehabilitation can take a considerable time and cause a hiatus in the athlete’s pre-planned training programmes, perhaps with devastating effects on their ability to perform at the highest level within a particular timeframe. It is important that we, as physiotherapists, are constantly on our guard to correct any movement faults in our patients in an effort to avoid future issues.

Athletes, particularly those competing at recreational level, usually only seek the advice of physiotherapists once they are injured, so it should be part of our educational remit to ensure that coaches, teachers and other staff involved in all levels of sport are aware of good, and hence of poor or inadequate, movement patterns. They do not have to be able to correct it; that is the physiotherapist’s remit, but they should be able to identify any potential problems. This should be relatively easy for experienced coaches as they are used to assessing how well an athlete moves, but identifying possible movement issues may be more difficult for less experienced coaches.

It is important that everyone involved with an athlete’s development is fastidious about insisting on good exercise / movement execution. We are not doing the athlete any favours if we allow them to progress before a good movement pattern is an automatic response in any given situation. This is probably the nub of the problem; with practice, most athletes can become adept at performing an exercise in a clinical environment, but once they return to their sporting environment they have to be able to deal with other external factors such as limited space, a sense of urgency when performing a task, teammates and opposition players, tactical considerations, environmental issues etc. In the process of giving their attention to these other factors, the athlete often cannot focus on performing the movement pattern as they have in the clinical setting, and their technique often deteriorates. In effect, the preceding treatment / rehabilitation has achieved very little in terms of injury prevention or performance enhancement.

Much has been written about how young athletes develop and the differences between their chronological and developmental age as they pass through puberty. Bayli & Hamilton (2004) discussed long-term athlete development (LTAD), bringing together musculoskeletal medicine, exercise physiology, coaching, strength and conditioning, nutrition and other disciplines to establish how an athlete’s physical, technical and tactical sporting development should proceed. This approach has now been revised (Lloyd *et al* 2012) but the basic principles have helped to establish a more holistic approach to the development of young athletes. Within the designated timeframes of LTAD, there is ample scope

for physiotherapists to influence how young athletes develop, in particular to ensure that they are not progressed to the next stage of training / exercise before they are physically prepared. The athlete must not only be skilful, they must be able to maintain good movement patterns even with an increase in load (which in this context refers to the overall volume of activity rather than a specific weight being lifted), increase in velocity or with the onset of fatigue.

We must not fall into the trap of assuming that “early developers” – those more than one year above chronological age (Johnson *et al* 2009) who tend, at an early age, to be bigger, stronger and faster – will necessarily be the better athletes in adulthood. There is evidence to show that early maturing boys gain advantages in increased shoulder breadth and upper body muscle mass, resulting in an increase in strength, power and aerobic capacity, while late maturing girls have a more linear physique, lower weight-to-height and hip-to-shoulder ratios, less fatness and relatively longer legs; all of which are associated with successful sporting performance (Williams 2007). Unfortunately, it is not unusual to see young athletes who excelled at their sport at an early age failing to develop the work ethic required to continue to excel as they progress into senior, or adult ranks.

Unless an athlete is rehabilitating from, or has had a previous injury, it is difficult to persuade them to work at injury prevention regimes and most patients have a tendency to reduce or stop an exercise programme once their pain has settled. However, most athletes will apply themselves more diligently if the exercises are designed to enhance sporting 

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performance. It is difficult to think of an exercise prescribed to “prevent injury” that does not also enhance performance. Greater adherence to an exercise programme may be gained if the exercises are described as performance enhancing rather than injury preventing.

Poor movement patterns result in compensatory movements and additional strain on secondary restraints. A muscle’s ability to absorb force is probably one of its most important functions and we can see this in many of the faulty movement patterns we observe. Even if a sport does not have an obvious jump and land component, any activity which involves running does require a good landing technique and assessing the mechanics of landing and the body’s ability to cope with the forces placed on it is essential in many sports. Remember that even if their sport doesn’t involve running during competition, athletes may be running as part of their aerobic training programme.

Assessing a person’s ability to produce a good movement pattern is relatively easy. Determining where a faulty movement pattern is originating, and why, may require a more in-depth assessment. It is too simplistic to think that a golfer who moves his hips and lower limbs excessively during the backswing has poor “core” control of his lumbo-pelvic area or hips, the excessive movement could be compensating for limited thoracic rotation or limited hip rotation (Booth & Forrest 1999). It is much less problematic for the athlete to learn, and the physiotherapist to teach, good movement patterns in the first instance and some practitioners have devised specific exercises for their sport which incorporate several movements within one exercise (Johansson & Larsson 2007). Good movement patterns require the facility

of movement under control. Even relatively stable sporting actions such as golf or archery require the athlete to remain within their base of support while withstanding forces from the swing of the club or the resistance of the archery bow string. An athlete’s ability to maintain a side plank may be assessed because the sport requires the athlete, for example a hockey goalkeeper, to maintain that position on the ground, or for a football goalkeeper to maintain the position in the air, or because the athlete may have to withstand rotational forces such as those experienced by a golfer.

Deciding which movement patterns are required for the best skill execution for a particular sport, and then which small number of exercises will help to improve those movement patterns, while making the smallest demand on the athlete’s time, can be challenging.

John Grace (2013) reminds us that “*One common mistake is to design training methods which look like the event itself, but neglect to meet the exact energetic, metabolic, and nervous system requirements*”. The FIFA 11+ warm-up programme (FIFA 11+ website) reinforces what we already know about movement patterns and shows how the warm-up can be used as a way of reinforcing good movement patterns and “pre-activating” muscle groups before more intense exercise. Time is often an issue when providing exercise programmes for young athletes who are already trying to juggle school, homework, training, competition and social life. If the warm-up can be designed to emphasise good execution of relevant movement patterns the athlete has “ticked the box” in terms of undertaking the relevant exercises without requiring any more time. Using the warm-up is a stepping stone from practicing the exercise in a clinical environment to starting to produce good movement patterns in

a sporting environment. As the athlete becomes adept at the correct movement patterns, speed, load and finally opposition, in those sports which have direct opposition, need to be gradually included into the exercise programme and replicated in the sporting environment. Once the athlete can maintain good movement patterns in the warm-up, they need to be reviewed, and corrected, during their training and, eventually, in more competitive environments, particularly as they start to fatigue: when good execution of the movement may start to deteriorate, either through muscle groups fatiguing at different rates or because the athlete is becoming mentally fatigued and can no longer focus on producing the most efficient and effective movement.

If you are only able to review your athletes in a clinical or gym environment then you must add speed, followed by load and other distractions to the assessment and exercises. If we can show the relevance of the exercise to the athlete they are much more likely to adhere to the programme. Explaining to athletes that working on gluteal control in a lying position will benefit their hockey may not carry much weight. However, being able to explain that as the exercise is progressed they will be able to run to an opponent at speed, get low into the tackle, maintain their balance to take the ball and then accelerate away may gain better adherence to the programme.

Of course it is not possible to know the specific demands of every sport, although some basic movements, such as the ability to squat, are important in many sports. A short video clip, easily accessible via the internet, can provide an understanding of the sport’s requirements, the movements involved and the physical demands placed on the

athlete. In addition, athletes are always ready to give a blow by blow description of their sport. Viewing the video clips will assist in understanding the combined movements of the upper and lower limbs, how the forces are transferred from the lower to the upper body, and vice versa, and the importance of being able to dissociate movements in all three planes of motion, e.g. at the hip-lumbar-pelvic region and between the thoracic and lumbar spine.

If the physiotherapist is able to guide the athlete's physical development before they incur an injury, it may be helpful to monitor the athlete's skeletal growth, a task that may be as simple as plotting height on a graph, in order to judge when they are approaching peak height velocity (PHV) (Bayli & Hamilton 2004). Elite male youth soccer players have been shown to have an increase in traumatic injuries in the year of PHV (Read *et al* 2015), and a basic monitoring of height can help to inform athletes, as well as their coaches and parents, why they may be more vulnerable to injury or why their athletic performance appears to be deteriorating compared to their peers who may be at a different stage in their physical development.

Physiotherapists, with their knowledge of anatomy, understanding of the musculoskeletal system, ability to assess patterns of movement, and ability to recognise compensatory or inappropriate movement, are well placed to be a valuable member of an athlete's support team. However, we must ensure that any corrective exercises and techniques to either enhance performance or prevent injury are being used effectively in the sporting environment and not just practised in clinics and gyms.

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