Prehabilitation: Preparing Young Athletes for Sports

P.Z. Pearce, MD

Corresponding author
P.Z. Pearce, MD
CHAMPIONS Sports Medicine, North Idaho Medical Center,
925 East Polston Avenue, Post Falls, ID 83854, USA.
E-mail: pearce.p@ghc.org
Current Science Inc. ISSN 1537-890x
Copyright © 2006 by Current Science Inc.

Great athletes may be born and not made, but I believe that there are many with great potential who succumb to noncontact injury through poor training habits, or as a result of correctable biomechanical imbalances. Preparing an athlete for sports requires medical and orthopedic evaluation, assessment of fitness for competition, and education in the principles of proper training. Because few individuals have access to a comprehensive sports medicine center, primary care physicians should familiarize themselves with the principles of prehabilitation to help young athletes prevent injury and realize their full potential.

Introduction
I ascribe to the belief that great athletes are born, and not made [1]. If you consider the myriad of complex physiologic and neuromuscular variables that define performance, it’s not hard to draw that conclusion. But I also believe that many potentially great athletes never have an opportunity to demonstrate their superior genetics, because of repeated noncontact injury. Coached by well-meaning parents with no particular expertise in proper form or technique, young athletes are susceptible to improper training, correctable biomechanical problems, and burn-out [2]. Prehabilitation is not a performance enhancement program, but rather a system of evaluating and educating young athletes, to reduce the risk of injury. It includes both static and dynamic assessment of flexibility, strength, and biomechanics, in addition to education in the principles of basic training and injury prevention.

Injuries are classified as developmental (scoliosis), environmental (altitude), metabolic (heat illness), traumatic, or overuse (repetitive motion). The most common (70%) of all injuries, and certainly the most preventable, are those that occur with overuse [3]. In addition to repetitive motion they always involve some form of training error, or biomechanical imbalance, which must be corrected for treatment to be successful. If the cause is determined during a preparticipation sports evaluation, athletes may actually be able to prevent a noncontact injury. Therefore, practitioners should include a discussion of the athlete’s training habits, in the sports-oriented medical history, and address biomechanical issues during the musculoskeletal examination.

Advanced evaluation includes analysis of complex motion, such as pitching mechanics, or swim stroke. Because most young athletes don’t have access to a comprehensive sports medicine center, it is incumbent upon primary care physicians to understand the fundamentals of biomechanical assessment, functional movement screening, and exercise physiology. Applying these skills in the preseason examination, and developing a network of physical therapists or coaches with expertise in specific sports, could help a great many young athletes to develop their full potential.

Evaluation
Preparticipation physical examinations have been somewhat controversial, largely due to a misunderstanding of their purpose [4]. They should not be considered a routine health examination for adolescents, nor a brief and inadequate “rubber stamp” clearance to satisfy risk-managers. They are an assessment of a young athlete’s preparedness to meet the physical and psychologic demands of sports. Participation has become so ubiquitous, and increasingly competitive, that evaluating young athletes requires a thorough examination. In that respect, the history and physical should be sport specific, addressing risk factors for sudden death, conditions that have a potential to limit performance, and training errors.

The examination should be done annually to reflect the changing biomechanics of growth in this population, and 6 to 8 weeks before training or competition, to allow time for rehabilitation of old injuries [5]. Fifteen to 20 minutes of office time are required, but a careful mass-screening process is much more effective. Because musculoskeletal evaluation obviously consumes the most time, having multiple stations with therapists or trainers involved, is more efficient. I believe that all young athletes, regardless of skill level, deserve a simple biomechanical assessment, including
functional movement screening, as part of their pre-participation physical examination.

**History**

The American Academy of Pediatrics maintains one of the most complete lists of limiting conditions for sports, and those in which exercise is contraindicated [6]. Although not universally accepted, I believe it takes into account that we are dealing with young athletes, and not professionals. Three questions with the greatest predictive value for sudden death in sports are a history of fainting with exercise, multiple episodes of fainting, and sudden death in a family member under age 50. The history should also inquire about treatable medical conditions that may limit performance, such as exercise-induced bronchospasm, anemia, and frequent cramping. Individuals with one gene for cystic fibrosis (1/31 whites) sweat unusually large amounts of sodium, and are predisposed to cramps or exercise-associated hyponatremia [7].

I feel the most important aspect of a sports history is to elicit a young athlete's possible training errors. Every practitioner should understand the basic principles of exercise physiology, and then utilize the expertise of a coach or trainer, when more sport-specific issues arise. The two most common errors represent opposite ends of a spectrum. Many young athletes begin the season unprepared to meet the physical demands of their sport, whereas others try to develop fitness in such a short period of time that they violate the "rule of twos" (too much, too hard, too fast, too soon). Young athletes, especially those with promise, suffer from external pressure to compete on several teams in succession, usually without time to recover between sports seasons. Similarly, strength athletes such as football players are often asked to wrestle, which puts joints fatigued by their primary sport in jeopardy of serious injury. Finally, parents and coaches, realizing the possibility of a scholarship or elite sport status, realize the potential for unique injuries (swimmer's shoulder), it is important to assess the athlete's training log may provide insight into these common errors. Because some sports involve complex technique (swim stroke), which predisposes to unique injuries (swimmer's shoulder), it is useful to inquire about whether an athlete has attended any camps or received other individualized instruction.

**Physical examination**

Most family physicians perform a thorough medical evaluation of athletes, but pay little attention to the musculoskeletal system. For that reason, potentially limiting conditions, including unrehabilitated injuries, are often overlooked. A good, basic musculoskeletal examination includes testing all joints for range of motion, and stability. Major landmarks should be palpated for tenderness, then flexibility and strength of all muscle groups tested. Certain sports place specific demands on joints (eg, knee and ankle in football, shoulder and elbow in baseball), so additional evaluation is warranted in these athletes. Injuries that have not been fully rehabilitated during the off-season should be addressed, and a treatment plan formulated. Finally, a screening biomechanical assessment should be done. This has the greatest impact on preventing noncontact injury, but unfortunately is rarely performed by primary care physicians. Many good resources are available that present a thorough but relatively simple examination of the musculoskeletal system [8].

**Biomechanical assessment**

Begin your evaluation with the athlete standing, arms at his or her sides. Approach from behind, and place finger tips on the shoulders then pelvis to assess spinal alignment and limb length. If both the shoulder and hip on one side appear to be higher than the other, suspect a leg-length inequality. Palpate the sacroiliac joints for tenderness, and assess the arches, to exclude sacroiliac rotation or unequal pronation as a possible cause. When the shoulder and hip inequality is on opposite sides, check for scoliosis by having the athlete bend forward. The diagnosis is confirmed if a rib hump appears, usually involving the right posterior chest. There is no support in the literature for the common misconception that patients with a left thoracic curve should be screened for cardiac anomalies [9]. Viewing the athlete from the front, once again assess the arches, and look for malalignment of the knees (valgus or varus deformity) or patellae. The Q-angle is measured between a line drawn from the anterior superior iliac spine through the center of the patella, and a similar line that extends upward from the tibial tubercle. Greater than 10° to 15° is abnormal, and may cause patellar maltracking, which manifests as retropatellar pain syndrome. Remember that excessive pronation (easily correctable) results in internal tibial rotation, and aggravates Q-angle abnormalities. Complete the knee examination with an assessment of patellar mobility.

With the athlete prone, and knees flexed 90°, measure internal and external rotation of each hip, normally 45°. Although not correctable, abnormal hip rotation can predispose to maltracking. In that same position, flex the ankle to 90°, and assess the thigh-foot angle. Normal alignment is 5° to 10° of external tibial torsion. With the athlete supine, shoulder range of motion can also be assessed. Abduct the arm to 90° and measure the total excursion, which is 180°. It is widely accepted that the increased external rotation seen in the dominant arm of throwing athletes, comes at the expense of internal rotation [10]. Repeated throwing can result in a tight posterior capsule, further limiting internal rotation, and reducing the mobility to less than 180°. When this internal rotation deficit exceeds 25° (ie, total excursion < 155°), the athlete is at risk for a superior labral tear (SLAP lesion) [11]. I have the athlete perform an active straight-leg raise while...