

Physical conditioning for the prevention of overuse injuries in children.

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Tim Grover, the legendary physical trainer (Michael Jordan, Scottie Pippen, Charles Barkley, and Shaun Livingston, among others) has declared:

“Hundreds of games, thousands of hours, since they were old enough to pick up a ball. Peewee. Youth leagues. Summer camps. Travel teams. AAU. High school. College. A relentless schedule of games, practice, travel, and training, sometimes for multiple teams and leagues, with multiple trainers and programs. No time for rest or recovery. No time to play or train for other sports. End result: The same muscles, ligaments, tendons, and joints are used over and over again, in the same direction, the same angles, the same motions. What piece of machinery doesn’t eventually give out from repeated use over many years?”

This requires deep reflection in an age when, on a daily basis, dozens of new workout programs are conceived for increasingly younger populations. However, children are meant to be active, play, use their entire bodies, and not continuously work on the same aspects time and time again.

“Everyone wants to go fast and hard, but without the ability to decelerate, what happens? Eventually you crash. Any racecar driver can go at top speed, but elite drivers know when to speed up, when to slow down, when to stop. Explosiveness without the ability to decelerate will almost always result in injury. To me, it’s one of the most critical elements of effective training. But how many athletes want to learn to slow down and stop? It’s not sexy. But it’s essential.”

In an interview in 2013, Tim Grover summarized what researchers were able to later conclude between 2015 and 2019. As Tim Gabbet noted [1]: “the problem is not with training per se, but more likely the inappropriate training that is being prescribed.”

As noted by Duncan in 2019 [2]: “With the emergence of technology and dwindling physical education in schools, there is a severe lack of fundamental movement skills (FMS) among today’s youth. Meanwhile, participation in sports is rising and many young people are not prepared to handle the sport-specific workload they experience; leading to suboptimal performance and increased risk of injury.”

“When youth and adolescent athletes do engage in training, it is imperative that they are not treated as mini-adults and given overly advanced programs. Rather than specializing at a

young age, there should be a system in place to establish a well-rounded base that serves as the framework for the development of new and future motor skills. As the athlete matures, their adaptive capabilities and tolerance to training loads will be dependent on this. Thus, early sampling or diversification is recommended over early specialization and has been shown to correlate with less psychological “burn-out”, fewer injuries, and greater future performance [3].”

In fact, physical development precedes cognitive development in the adolescent population. Physical development is most prominent from early to mid-adolescence, whereas cognitive development, which includes structural changes at the level of the brain and cognition, continues maturing until the end of the third decade. Physical and cognitive changes of puberty and the rate with which these changes occur might ultimately lead to a temporary increase in the risk of injury and may even lead to overtraining syndrome in adolescents [4].

The risks of injury and overuse increase proportionately with the degree of the child’s sport specialization and not with the training load [5,6]. In fact, there is a higher risk of serious injury due to overuse in athletes who spend twice as much time participating in organized sports compared to those partaking in recreational play, even though both exert the same overall load (7).

In order to conclude the concept of training load, the primary factor in overuse injuries, it was previously shown that an optimal load exists that allows a decrease in the risk of injury through a progressive phase of adaptation taking into account the acute and global loads in a systematic fashion [1,8]. This is achieved with a predominance of circuit exercises, thereby avoiding monotony, coupled with regular unwinding periods [9]. The risk factor could be modeled with the following formula :

Risk factor =

$$\frac{V_{\text{volume}} \times I_{\text{intensity}}}{PR_{\text{Physical Recuperation}}} \times \frac{MF_{\text{Monotony factor}} \times SF_{\text{Specialization factor}} \times Y_{\text{Years of specialization}} \times E_{\text{demand for result}}}{CR_{\text{Cognitive recuperation}} \times PR_{\text{Psychological recuperation}} \times PF_{\text{play factor}} \times TF_{\text{Time factor}} \times CF_{\text{Capacity factor}}}$$

Moreover, aside from training load, the contents of training and particularly of physical conditioning play a predominant role in avoiding injuries [10,11]. Thus, physical preparation in children, as was underlined by Tim Grover, must not be tied solely on improving performance. In fact, power and speed are especially linked to the physiological age of the young athlete [12]. Therefore, it is fundamental to develop neuromuscular prophylactic measures combining both global postural and intermuscular coordination exercises [14] with an adapted load, all the while teaching the importance of rest [13]. Complex and varied motricity programs must be integrated in order to enrich neuromotor programs and neuromuscular qualities in a well-proportioned manner [2]. Fine and adaptable motor coordination, which indicate adaptable movements, allow the prevention of injuries and optimal performance in athletic children [15].

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