Journal of Bodywork & Movement Therapies 23 (2019) 619–621

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

PREVENTION & REHABILITATION: Self-Care Management

Self care Part 1. Athletic Development: Youth Considerations

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. The greatest risk of injury is not from the activity itself, but the lack of preparation for the activity. As noted by Tim Gabbett (2016): "its not the load that breaks you down, it's the load you're not prepared for."

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 (Cote et al., 2009).

This series will outline the structure of training for the development of a young athlete, from the initial preparatory phase to more specific, specialized preparation. There will also be an overview of common sport-specific injuries and the screening/testing process. When implemented properly, this gradual adaptation should lead to continuous performance improvements while also minimizing injury risk. The principles described in this series are equally applicable to a sedentary person, emerging elite athlete, or injured person. Everyone is truly an athlete.

Coaching children is about teaching them how to "develop" motor literacies and to find enjoyment with activity. Creating environments that provide a positive experience with movement encourages diverse activities, play, and sampling are a necessary self-care for prevention of childhood obesity, sedentarism, long term injury risk reduction and enhanced performance.

1. Fundamental movement skills

Sampling is proposed to build FMS. This provides a foundation for future movement skill (Baker et al., 2003):

- Locomotor skills (running, jumping, etc.)
- Object control skills (throwing, catching, striking, etc.)

Participating in a variety of sports at a young age helps develop FMS and the confidence that comes from learning different strategies (Cote et al., 2009). Preadolescence is the optimal window during which to develop FMS (Gallahue and Ozmun, 2006; Lubans et al, 2010). Ideally, this should occur in the "developmental window" prior to the period of "peak height velocity" (Myer et al., 2011). By age 7, differences in body size due to a bifurcation in biological versus chronological age become evident (Malina et al., 2005). Therefore, children who grow at a younger age should have this coordination-based training initiated earlier. Hence, diversification of activities in children has been shown to contribute to the development of FMS (Gallahue and Ozmun, 2002). These basic skills then continue to develop from childhood to adolescence to the teenage years (Fulton et al., 2001; Okely et al., 2001). FMS are thus an essential prerequisite—the building blocks—for participation in more specialized activities and sports later (Gallahue and Ozmun, 2002; Payne and Isaacs, 1995).

2. Training = Preparation

There are common situations where sport programs, coaches, and parents have a misguided perception of what effective training entails. It is important that training should prepare the athlete for all the demands of their sport in the safest and most efficient manner, inducing the necessary adaptations. It should not be necessary to attempt to invent "sport specific" drills, follow the latest fad, or just lift weights. This requires a basic understanding of sport science and physiology, and coaches should appreciate how all of the systems in the body interact to accomplish a goal, and how to improve them. Since sports involve solving complex motor tasks, replenishing energy stores, and generating or interacting with external forces (from the ground, opponent, or object), biology will provide the principles needed to guide the training plan. These include:

Bio-Energetics – How energy is generated and restored in the body in response to activity (Anaerobic-Alactic, Anaerobic-Lactic, and Aerobic).

- Most games are decided in the fourth quarter. Therefore all of the strength and speed an athlete develops is only meaningful if they can continue to display it late in the game. Each sport has its own unique bioenergetic profile; for example, soccer will require more aerobic fitness than a 100m sprint which is almost purely alactic. Properly training for the energy requirements of the sport will allow the athlete to resist fatigue, improve/maintain performance, and be less vulnerable to injury.

Bio-Dynamics – Interactions between internal and external forces that allow an athlete to solve complex movement tasks (Dynamic Correspondence).

- Understanding the competitive movement(s) and how training will transfer to them is essential. The coach must consider

https://doi.org/10.1016/j.jbmt.2019.06.010
1360-8592/

multiple factors like the dynamics of the specific movement, the contraction type, rate of force production, or accentuated ranges of motion. For example, because the joint angles in a half squat more closely resemble those exhibited in a sprint, this movement will likely have a higher transfer to sprinting than a full squat (Rhea et al., 2016).

Bio-Motor Abilities – The different abilities (strength, power, endurance, speed, suppleness, skill) that allow an athlete to express movement.

- A youth athlete will begin by building all of these abilities until they have a solid foundation. From there, the coach will examine the dominant qualities of the sport as well as the strengths and weaknesses of the individual. For example, a football lineman will require more strength and power while a soccer player will prioritize speed and endurance. These independent abilities can all be trained and improved upon to enhance the athlete's movement potential.

The above points can be summarized by saying that the exercises chosen should serve to enhance the qualities above as they are related to the individual or their sporting event. If they do not, then they have no place in a training program.

3. Research on youth training

As the science on youth training evolves, it is the task of coaches to blend their first-hand experience with what is deemed as best practice in the literature. Overall, the authors conclude that a gradual, periodized training program has been reliably shown to reduce the risk of injury, improve performance, and promote mental health and general well-being. This brief literature review offers a sense of the key findings on some of the main training priorities.

Early Specialization and Training Load

4. Long-term athletic development

It appears that the solution to the rapidly disappearing fundamental movement skills of youths today may be found in simple play. Climbing the monkey bars, hide and seek, throwing balls, or catching, all encourage solving new movement tasks and help stimulate the development of the brain.

It has become apparent that many youth athletes are skipping these foundational stages of development and rushing to specialization and overtraining, while a general lack of strength, stability, and coordination in youth teams has led to a sharp rise in overuse and non-contact injuries, as well as high rates of burn-out (Rhea et al., 2016; Post et al., 2017; Zwolski et al., 2017). Allowing the athlete to gradually develop and enhance their overall athleticism can solve many of these problems.

A further important question is when organized training should begin. While each individual should be treated uniquely, there is a general consensus that some form of training can begin between 6 and 9 years old (Ford et al., 2011). This period is crucial as it will serve as the foundation for all future trainings. The coach's task is to provide a positive experience with movement while delivering recoverable stress and building a well-rounded athlete.

The next step is breaking the training down into stages based on the athlete's age (chronological and biological), their individual maturation rate, and their current level of trainability or readiness. The advancement from one stage to the next should be based on all the factors above, not just age alone.

- If certain physiological abilities (like speed), are not trained during specific windows, optimum development will not be reached (Ford et al., 2011). These are sensitive periods to training, pre- and post-puberty, where the “window of trainability” is at a heightened state. The first window for speed development is 6–8 for females and 7–9 for males (Ford et al., 2011).

Post et al. (2017)	“Athletes who played their primary sport more than 8 months of the year were more likely to report an upper extremity overuse injury or a lower extremity overuse injury.”
Zwolski et al. (2017)	“Youth throughout the physical activity spectrum are at risk for physical activity- and sports-related injury. Of highest priority are *early specializers*, physically inactive youth, and young girls, owing to increased injury rates.”
Jayanthi et al. (2015)	“Athletes who participated in their primary sport for more hours per week than their age (ie, a 16-year-old athlete who participated in his or her primary sport for more than 16 h/wk) were more likely to report an injury of any type in the previous year.”
Jayanthi et al. (2013)	“For those children who do choose to specialize in a single sport, periods of intense training and specialized sport activities should be closely monitored for indicators of burnout, overuse injury, or potential decrements in performance due to overtraining.”
Côté et al. (2009)	In an extensive position paper by Côté et al., the authors firmly stress that “early diversification is linked to a longer sport career” while “early specialization has been shown to shorten peak performance, increase drop out/burn out, and increase injuries in youth athletes.”

Training for Injury Reduction and Performance

Lauersen et al. (2013)	Out of 26,610 subjects, The British Journal of Sports Medicine found that strength training reduced sports injuries to less than one third and overuse injuries could be 50% lower if the athletes engaged in “adequate strength training.”
Zwolski et al. (2017)	“Resistance training in addition to free play and other structured physical activity training can serve as a protective means against injury and a positive catalyst for the development of physical literacy to offset the impact of diminishing physical activity and early sport specialization in today's youth.”
Myer et al. (2016)	“Last, the evidence indicates that all youth should be involved in periodized strength and conditioning (eg, integrative neuromuscular training) to help them prepare for the demands of competitive sport participation.”
Lesinski et al. (2016)	“This review included 43 studies which found resistance training to be an effective method to enhance muscle strength and jump performance in youth athletes.”
FIFA 11 + 2015 (Bizzini and Dvorak, 2015)	When implemented, the FIFA 11 + program led to a “significant reduction” (up to 50%) of injuries in female players aged 13–18,” as well as a “significantly lower (approximately 40%) incidence of injuries in young male players.”

- There also exist periods around Peak Height Velocity (the largest increase in body height), where the athlete may be at a higher risk of injury; therefore training/match loads must be closely monitored (Van Der Sluis, 2014, 2015).

In the next part of this series we will delve deeper into the foundational stage of development: ages 9–12; and discuss how to program for this group, from the warm-up to general exercise recommendations. From there, each developmental stage will be laid out with exercise prescriptions and strategies to reduce the risk of injury. This model is intent on providing a simple, easy to adopt program that respects the developmental stages of the athlete while advancing their performance and overall health.

References

Baker, J., Côté, J., Abernethy, B., 2003. Sport-specific practice and the development of expert decision-making in team ball sports. J. Appl. Sport Psychol. 15, 12–25.

Bizzini, M., Dvorak, J., 2015. FIFA 11+: an effective programme to prevent football injuries in various player groups worldwide—a narrative review. Br. J. Sports Med. 49, 577–579.

Côté, J., Lidor, R., Hackfort, D., 2009. ISSP position stand: to sample or to specialize? Seven postulates about youth sport activities that lead to continued participation and elite performance. J. Sport Exerc. Psychol. 9, 7–17.

Ford, Paul, De Ste Croix, Mark, Lloyd, Rhodri, Meyers, Robert, Moosavi, Marjan, Oliver, Jon, Till, Kevin, Williams, Craig, 2011. The long-term athlete development model: physiological evidence and application. J. Sport. Sci.

Fulton, J., Burgeson, C., Perry, G., et al., 2001. Assessment of physicalactivity and sedentary behavior in preschool-age children:priorities for research. Pediatr. Exerc. Sci. 13, 113–126.

Gabbett, T.J., 12 January 2016. The training-injury prevention paradox: should athletes be training smarter and harder? Br. J. Sports Med. Published Online First.

Gallahue, D.L., Ozmun, J.C., 2002. Understanding Motor Development:Infants, Children, Adolescents and Adults, fifth ed. McGraw-Hill, Dubuque, IA.

Gallahue, D.L., Ozmun, J.C., 2006. Understanding Motor Development:Infants, Children, Adolescents, Adults. McGraw Hill, Boston.

Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., Labella, C., 2013. Sports specialization in young athletes: evidence-based recommendations. Sports Health.

Jayanthi, N.A., et al., 2015. Sports-specialized intensive training and the risk of injury in young athletes: a clinical case-control study. Am. J. Sports Med.

Lauersen, Bo, Jeppe, et al., 2013. The effectiveness of exercise interventions to prevent sports injuries: a systematic review and meta-analysis of randomised controlled trials. (BMJ Publishing Group Ltd and British Association of Sport and Exercise Medicine). Br. J. Sports Med. Oct. 5.

Lesinski, M., et al., 2016. Effects and dose-response relationships of resistance training on physical performance in youth athletes: a systematic review and meta-analysis. Br. J. Sports Med.

Lubans, D.R., Morgan, P.J., Cliff, D.P., et al., 2010. Fundamental movements kills in children and adolescents: review of associated health benefits. Sports Med. 40, 1019–1035.

Malina, R.M., Cumming, S.P., Morano, P.J., et al., 2005. Maturity status of youth football players: a noninvasive estimate. Med. Sci. Sports Exerc. 37, 1044–1052.

Myer, G.M., Faigenbaum, A.D., Ford, K.R., et al., 2011. When to initiate integrative neuromuscular training to reduce sports related injuries and enhance health in youth? Am. College Sp. Med. 10, 157–166.

Myer, G.D., et al., 2016. Sports specialization, Part II: alternative solutions to early sport specialization in youth athletes. Sports Health.

Okely, A., Booth, M., Patterson, J., 2001. Relationship of physicalactivity to fundamental movement skills among adolescents. Med. Sci. Sports Exerc. 33, 1899–1904.

Payne, V., Isaacs, L., 1995. Human Motor Development: A Lifespan Approach. Mayfield Publishing Company, Mountain View, CA.

Post, E.G., et al., 2017. The association of sport specialization and training volume with injury history in youth athletes. Am. J. Sports Med.

Rhea, Matthew, G Kenn, Joseph, Peterson, Mark, Massey, Drew, Simão, Roberto, Marín, Pedro, Favero, Mike, Cardozo, Diogo, Krein, Darren, 2016. Joint-angle specific strength adaptations influence improvements in power in highly trained athletes. Hum. Mov. 17.

Van Der Sluis, A., et al., 2014. Sport injuries aligned to peak height velocity in talented pubertal soccer players. Int. J. Sports Med.

Van Der Sluis, A., et al., 2015. Importance of peak height velocity timing in terms of injuries in talented soccer players. Int. J. Sports Med.

Zwolski, C., et al., 2017. Resistance training in youth: laying the foundation for injury prevention and physical literacy. Sports Health.

Fred Duncan*, Nicole Rodriguez, Craig Liebenson

* Corresponding author.
E-mail address: Fredduncantraining@gmail.com (F. Duncan).