

Skill Development and the Strength & Conditioning Coach

Brian McCormick

Boston Sports Medicine and Performance Group

Purpose

Discuss the role of the Strength & Conditioning Coach in **skill development** with respect to jump landings as it pertains to ACL injury prevention in female basketball players.

Introduction

Three events leading to this topic:

1. Watching a local S&C coach train a DI Women's basketball team.
2. The misreporting of the Jump-Stop study out of U.C. Davis.
3. *New York Times* article about ACL injuries.



What is the role of the Strength & Conditioning Coach?

Bigger, Faster, Stronger

“Athletic Development Coach: Athletic Development is defined as the process of evaluating and training **all the components of athleticism** according to the demands of the sports and the qualities of the individual athlete. It is based on the understanding that athleticism is the ability to perform athletic movements (run, jump, and throw) at optimum speed with precision style and grace. This is clearly **more than strength and conditioning.**”

- Vern Gambetta, 2006

“Strength training is coordination training with resistance,”

- Jim Radcliffe, University of Oregon Strength & Conditioning Coach

Premise

Basketball Coaches are not movement experts.



“Greatness is finding a void and filling it,”
- Jim Valvano

What is Learning?

Learning is a gradual process that occurs over many performance attempts, resulting in behavior that is less vulnerable to transitory factors such as fatigue, audience effects and anxiety.

(Davids, Button & Bennett, 2008)

Infer Learning

Performance Characteristics

- 1.Improvement (New behaviors, reduce errors)
- 2.Consistency (Reduce variability)
- 3.Stability (Return to response after perturbation)
- 4.Persistence (retention after a period of no practice)
- 5.Adaptability (context, skill)



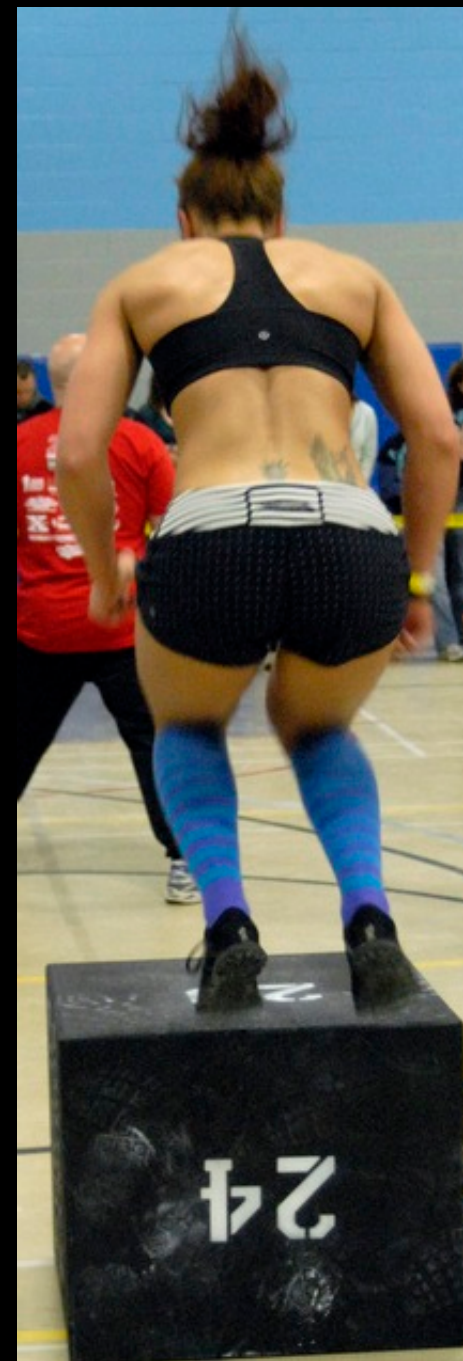
Task Constraints



Person (experience, strength, skill level)

Environment (playing conditions, surface)

Task (time, space, speed, precision)



Jump Landings and the Jump Stop

Where do ACL injuries occur?

29/39 injuries occurred when attacking;
5 occurred while defending;
2 occurred after a rebound; and
1 occurred during a turnover.

(Krosshaug et al., 2006)

Rebounding was the most often cited maneuver associated with ACL injuries in female basketball players.

(Powell and Barber-Foss, 2000)

Krosshaug et al. (2006). Mechanisms of Anterior Cruciate Ligament Injury in Basketball: Video Analysis of 39 Cases. *American Journal of Sports Medicine*, 35; 359-367.

Powell JW, Barber-Foss KD. Sex-related injury patterns among selected high school sports. *Am J Sports Med*. 2000;28:385–391.

Where do ACL injuries occur?

25/39 injuries involved a landing;
4 involved cutting;
4 involved a direct blow;
6 were undetermined.

(Krosshaug et al., 2006)

11/39 injuries involved contact.
In 22 of remaining 28 cases, another player was
within 1 meter at the time of the injury.

(Krosshaug et al., 2006)

Skills Effects on Knee Biomechanics

McLean et al. (2004) showed that the introduction of a static defender in cutting maneuvers alters knee biomechanics significantly.

Ford et al. (2005) showed that using an overhead goal in vertical jumps alters the knee biomechanics significantly.

Ford KR, Myer GD, Smith RL, Byrnes RN, Dopirak SE, Hewett TE. Use of an overhead goal alters vertical jump performance and biomechanics. *J Strength Cond Res.* 2005;19:394-399.

McLean SG, Lipfert SW, Van Den Bogert AJ. Effect of gender and defensive opponent on the biomechanics of sidestep cutting. *Med Sci Sports Exerc.* 2004;36:1008-1016.

The Coaching Solution: Ignore or Eliminate

“Chris Dailey, UConn’s associate head coach, says players are taught that if they cannot pass the ball before a teammate reaches the opponent’s free-throw line on the fast break, not to attempt the play. This is to keep players from having to stop suddenly to avoid going out of bounds or to make a move that puts their bodies in an awkward position,” (Longman, 2011).

Basketball Coaches

Jump stops *cause* ACL injuries.



To prevent ACL injuries, we will not teach jump stops.

You cannot eliminate jumping and landing from basketball!



Jump Landings and ACL Injuries

“When landing, UConn players are taught by the trainer Rosemary Ragle to bend at the hips and knees to softly absorb the load, keeping their knees behind the toes, striking the ground toe to heel. The knee should be in a neutral position; ideally, Tennessee’s Moshak said, the center of the kneecap should be aligned with the second toe.”



Dinosaur or Cockroach?



Strict “correct” movements do not expand the body’s ability to **adapt** to the demands of the sport.

Sterile and artificial training environments and scenarios result in **adapted bodies** that cannot change and adjust to the random and chaotic demands of the sport.

Open challenging movement enriched environments create **adaptable athletes** who are able to adjust and modify movements on demand. These **adaptable athletes**, given a level of talent, are **high performers** and **stay injury free**.

Do you want a **dinosaur** type who is completely **adapted** and on his way to extinction or a **cockroach** type athlete who is thriving and highly **adaptable**?



Gentile's Taxonomy of Motor Skills

Action Potential

| | Body Stability | | Body Transport | |
|--|------------------------|---------------------|-----------------------------|----------------------------|
| | No Object Manipulation | Object Manipulation | No Object Manipulation | Object Manipulation |
| Stationary Conditions/ No Intertrial Variability | BW Squats | Back Squats | Box Jumps | |
| Stationary Conditions/ Intertrial Variability | | | Repeat, Varied Hurdle Jumps | |
| In-Motion Conditions/ No Intertrial Variability | | | | |
| In-Motion Conditions/ Intertrial Variability | | | | Game jump stop off dribble |

Altering movement mechanics to reduce ACL loading

The Jump Stop intervention targeted:

1. Increasing the amplitude of the jump prior to landing;
2. Increasing the amount of knee flexion at landing;
3. Striking the ground with the toes first.

(Myers and Hawkins, 2010)



Myers, C.A. & Hawkins, D. (2010). "Alterations to movement mechanics can greatly reduce anterior cruciate ligament loading without reducing performance" *Journal of Biomechanics*: 43, 2657-2664.

Jump Stop Skill



“Jump stops were performed with the toes striking the ground **first** during the intervention condition versus the majority of jump stops performed with the heels striking the ground first in the baseline condition.”

(Myers & Hawkins, 2010)

Myers, C.A. & Hawkins, D. (2010). “Alterations to movement mechanics can greatly reduce anterior cruciate ligament loading without reducing performance” *Journal of Biomechanics*: 43, 2657-2664.

Motor Control

Feed-forward motor control uses advance information about a task, usually from experience, to preprogram muscle activity.

(Swanik et al., 1997)

Preparatory muscle activation prior to landing is considered to be preprogrammed...increase in muscle activation levels increases muscle stiffness properties...which provides dynamic support for functional stability.

(Swanik et al., 1997)

Motor Control and Fatigue



During testing, a flashing light cued the subjects to jump in a certain direction, and the more fatigued the subjects became, the less likely they were able to react quickly and safely to the unexpected command.

The research suggests that **training the brain to respond to unexpected stimuli**, thus sharpening their anticipatory skills when faced with unexpected scenarios, may be more beneficial than performing rote training exercises in a controlled lab setting, which is much less random than a true competitive scenario.

(Brown et al., 2009)

Repeat Jumps vs. Deceleration

In a repeat jump [offensive rebound, jump stop before shooting], energy must be stored and released...therefore preparatory muscle activity increases muscle stiffness.

(Swanik et al., 1997)



During a landing or deceleration, energy must be absorbed, so muscle stiffness remains low.

(Swanik et al., 1997)

Swanik, C.B., Lephart, S.M., Giannantonio, F.P. and Fu, F.H. (1997). Reestablishing proprioception and neuromuscular control in the ACL-injured athlete. *Journal of Sports Rehabilitation*, 6, 182-206.

Brian McCormick
coachmccormick@hotmail.com
<http://developyourbbballiq.com>