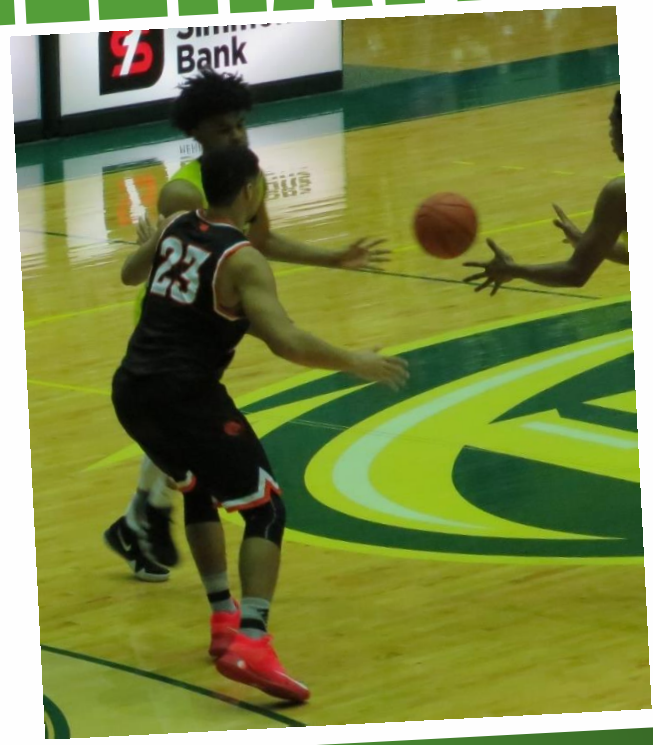
LOWER-BODY DECELERATION PROGRAMMING



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THANK YOU

- CSCCa Conference Committee and Dr. Chuck Stiggins for this opportunity
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- My weightlifting and S&C mentor Mike Gattone
- My sport science mentor Dr. Patricia Eisenman
- Special thanks to James DiNaso for discussions on this topic

DECELERATION

DECELERATION

- The act of rapidly slowing the body or body part as part of a movement or as the cessation of a movement

Locomotive
Sprinting: COD, Stopping

Landing
Plyometrics, WL Catch

Follow Through
Throw, Kick

DECELERATION

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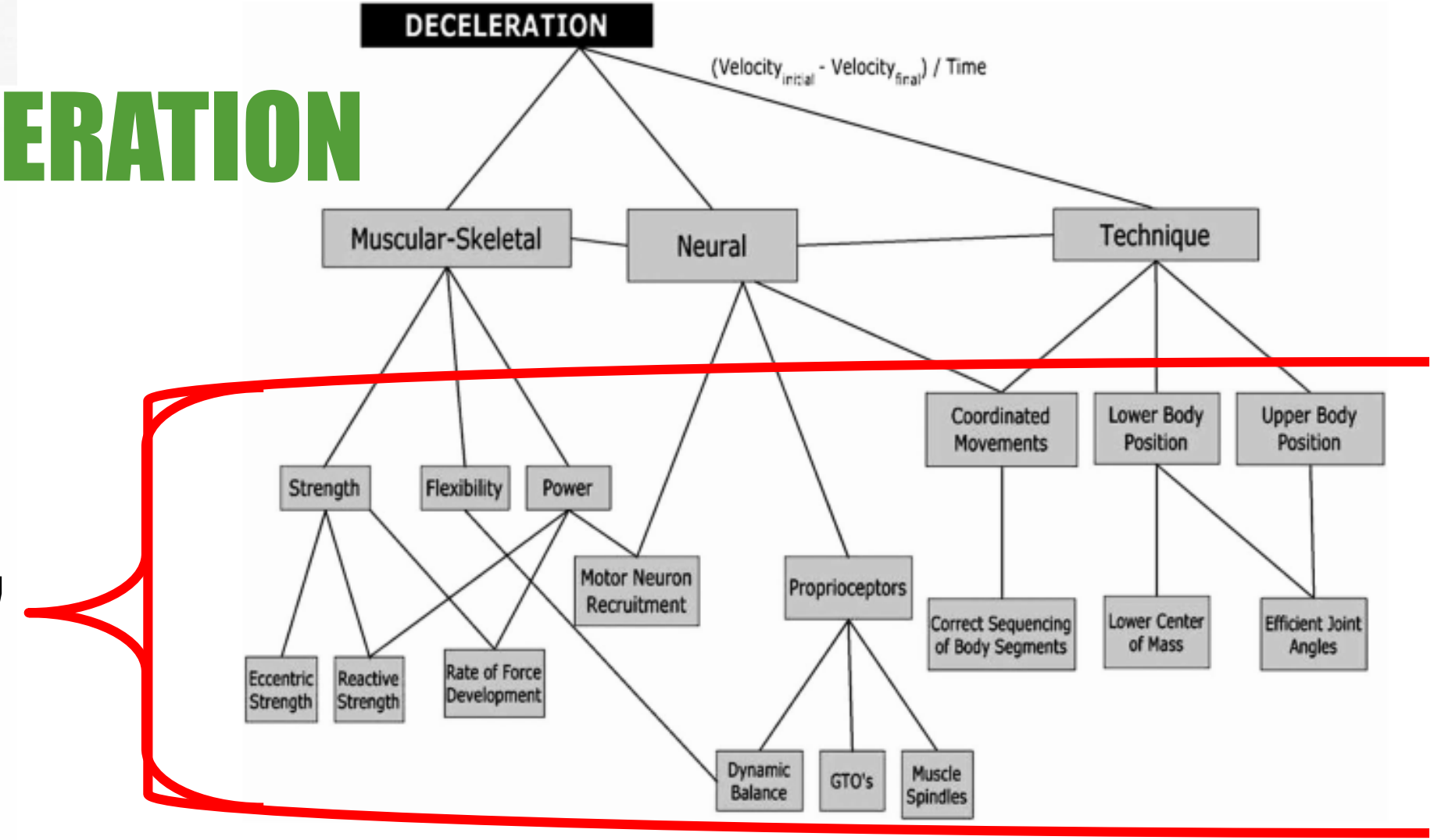


Figure 1. Deterministic model of deceleration.

Kovacs, MS, Roetert, EP, and Ellenbecker, TS. Efficient Deceleration: The Forgotten Factor in Tennis-Specific Training. *Strength Cond J*. 28(6): 58-69, 2008.

DECELERATION

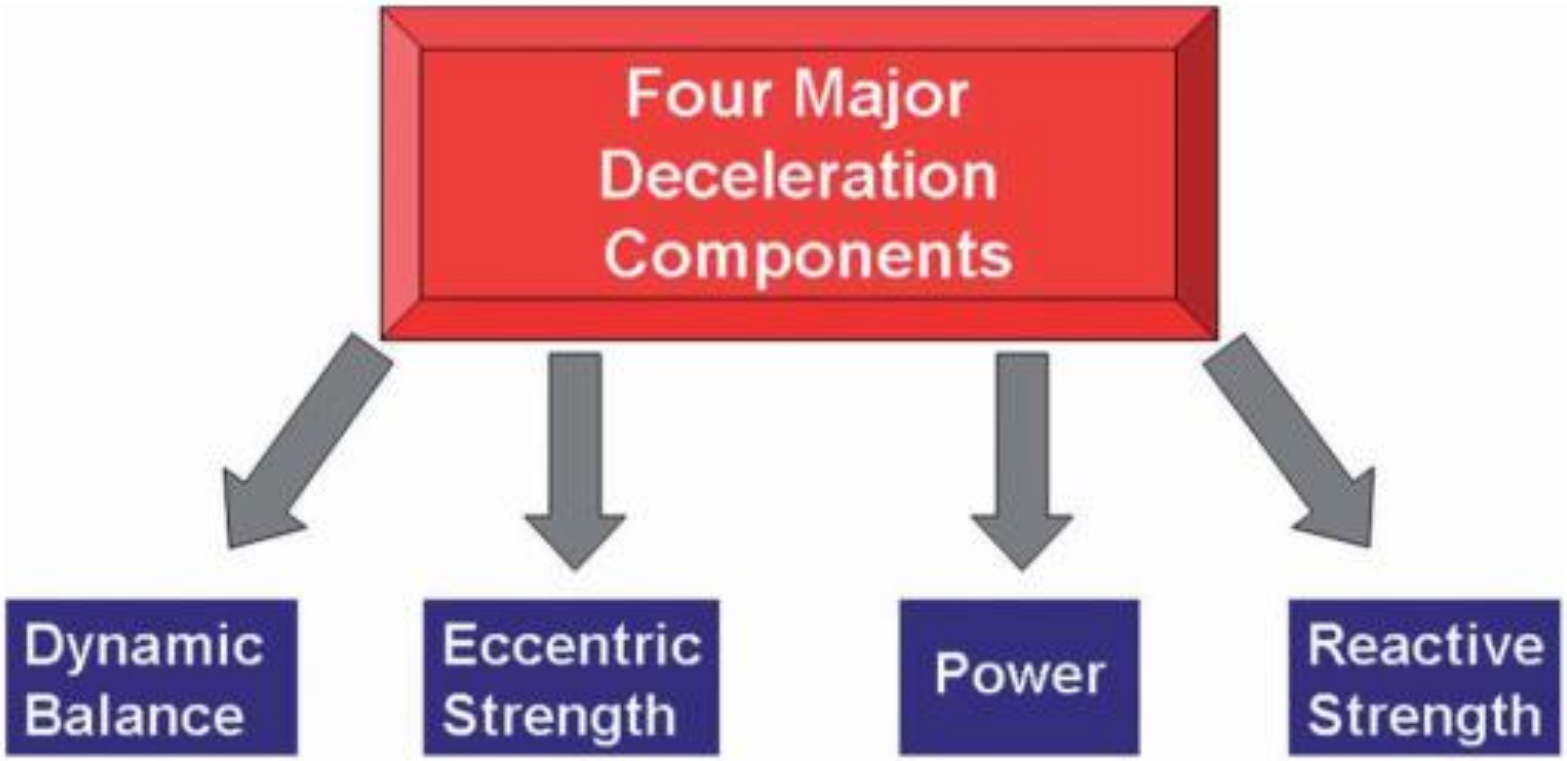
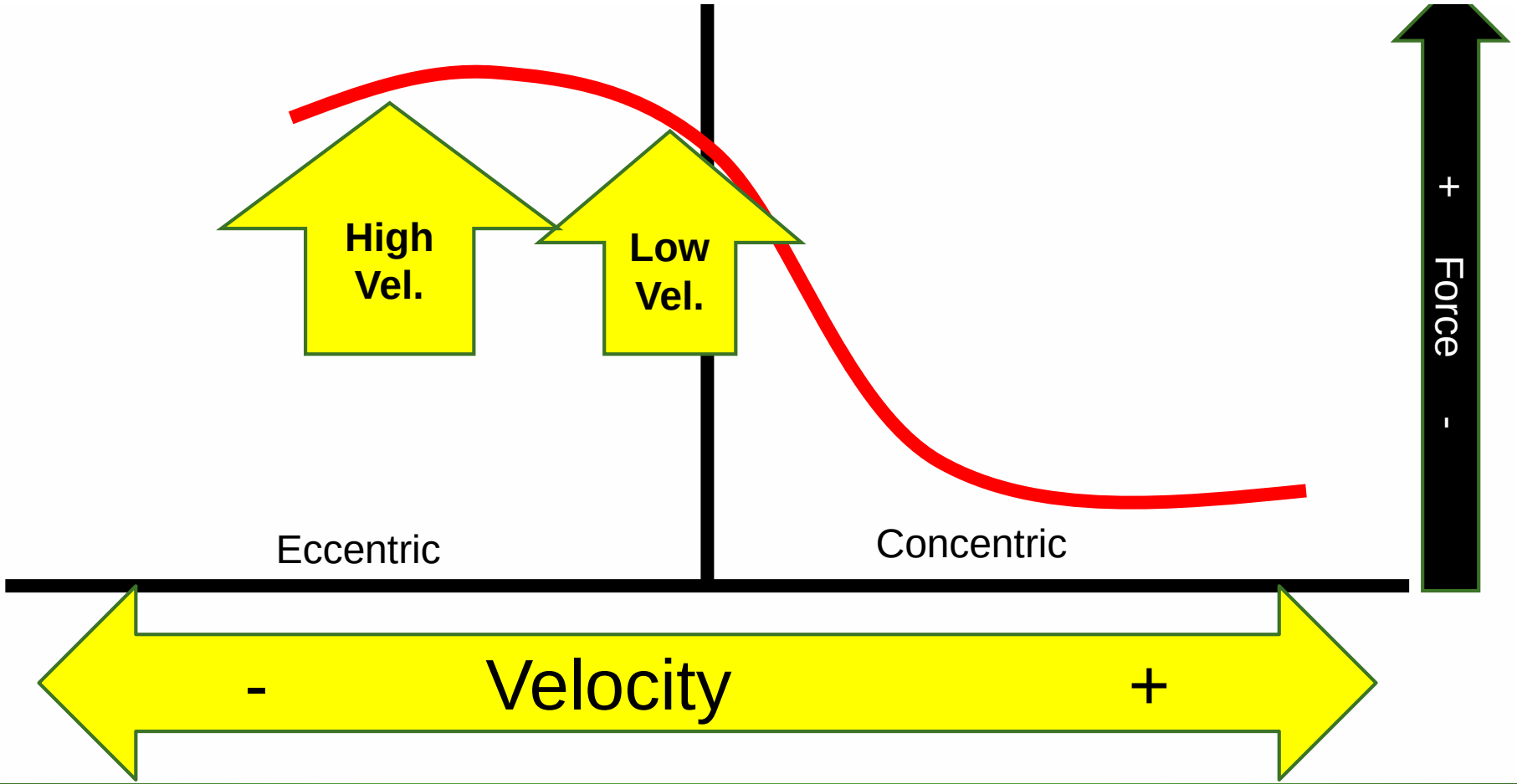


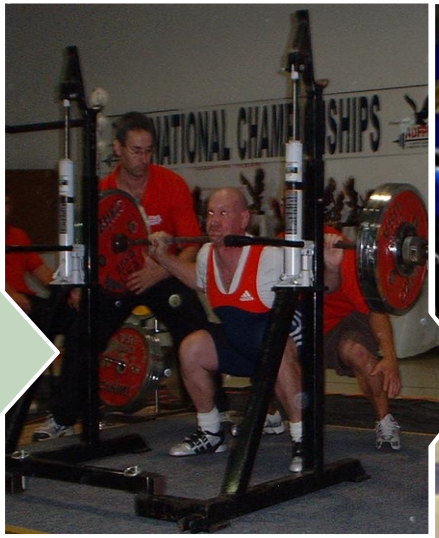
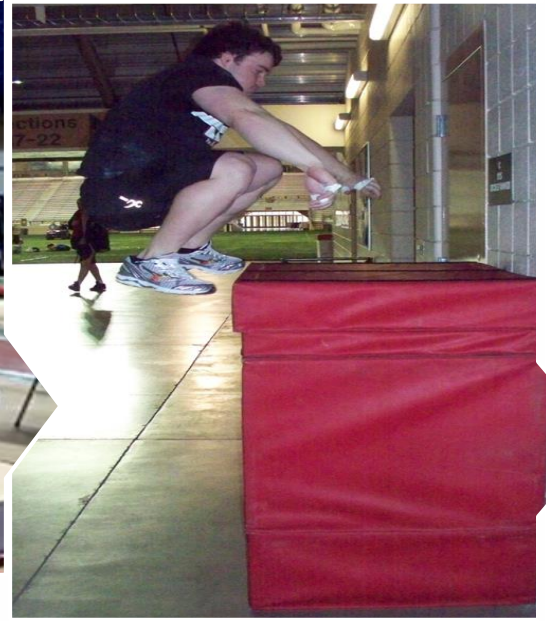
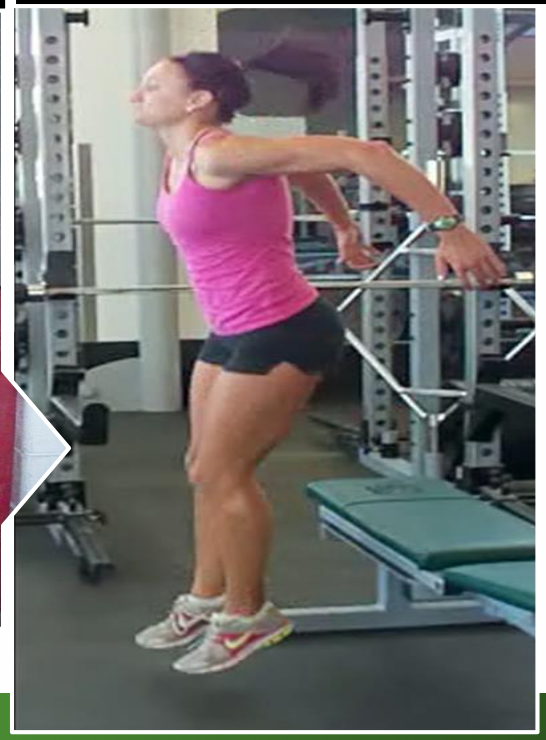
Figure 4. Four major deceleration components.

Kovacs, MS, Roetert, EP, and Ellenbecker, TS. Efficient Deceleration: The Forgotten Factor in Tennis-Specific Training. *Strength Cond J*. 28(6): 58-69, 2008.

DECELERATION



DECELERATION – MUSCULAR ACTION (ECCENTRIC)

Low Force – Low Velocity	High Force – Low Velocity	High Force – High Velocity	Low Impact Force – High Velocity	High Impact Force – High Velocity
Body-weight Squats Rear Leg Elevated Split Squat SL ECC Box Squat				

DECELERATION – COACHING VISUAL ANALYSIS

DECELERATION - VISUAL ANALYSIS

Kinematics for Sprint Deceleration Phase < 5m

- COM is posterior to foot contact
- Short step length
- Wide step width (> hip width)
- Higher step frequency
- Landing distance increased
- Braking/eccentric increased
- Larger joint angle displacement
- Posterior trunk lean
- Velocity will decrease to ZERO (may only last ms)

Hewit, J, Cronin, J, Button, C, and Hume, P. Understanding Deceleration in Sport. *Strength Cond J*. 33(1): 47-52, 2011.

DECELERATION

SPECIFIC ATHLETIC POPULATIONS

- 1st and 2nd year
- Transfers
- Post-physical therapy

TESTING CATEGORIES

- Locomotive (e.g. Agility)
- Unilateral & bilateral plyometrics
- Unilateral & bilateral strength
- Bilateral strength-speed

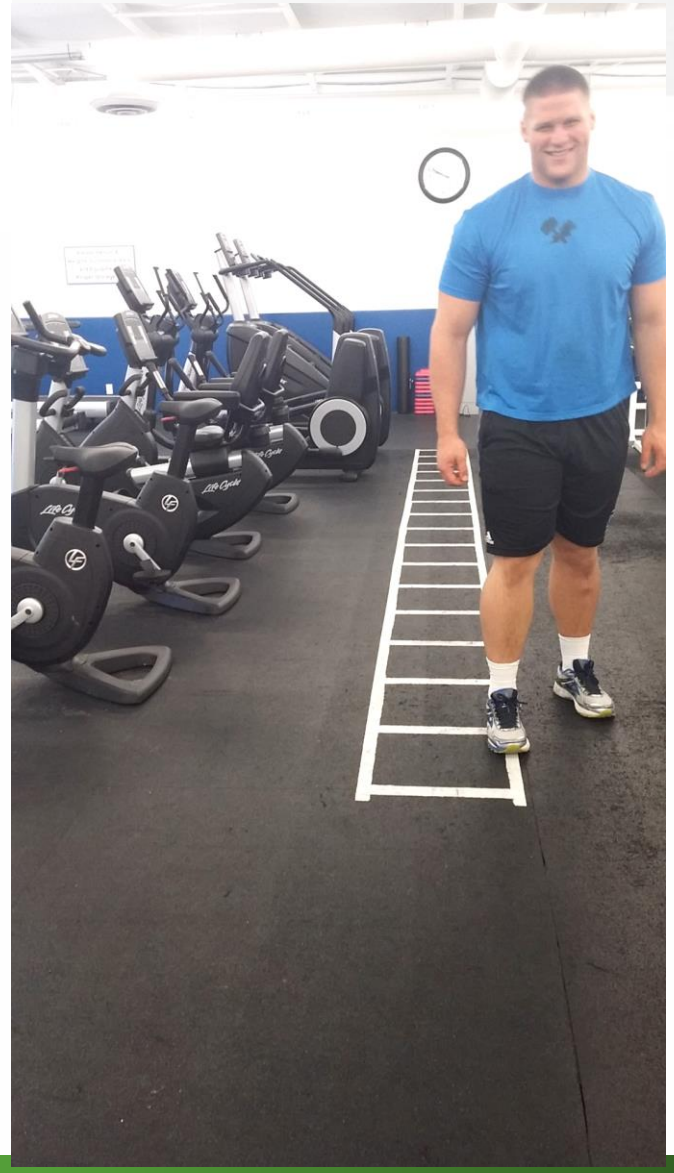
DECELERATION: TESTS

- 5-0-5
- Pro-agility (5-10-5)
- T-drill test
- L & pattern sprints
- Sprint (v_{max}) & stopping distance

FOCUS IS ON TECHNIQUE TO STOP AND COD

DECELERATION: TESTS

- 360° hop (Moody, S, 2015)
- Box drop landing*
- Vertical countermovement jump (*landing)
- 1-step approach* CMJ_{vert}
- Depth $jump_{vert}$
- Bounds (contacts measure distance)
  - All jumps/hops can also be performed horizontal
- FOCUS IS ON LANDING/IMPACT TECHNIQUE



By definition: Hops are leaving the ground from one foot and landing on the same foot.

DECELERATION: TESTS

STRENGTH

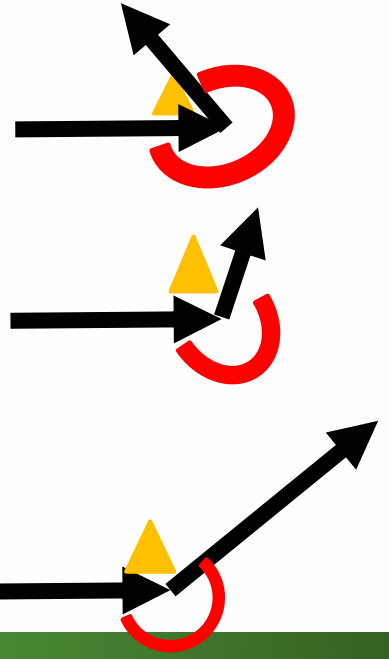
- Back, front squats
- Single leg box squats
- Step-ups
  - Athlete's ability during the eccentric phase

STRENGTH-SPEED

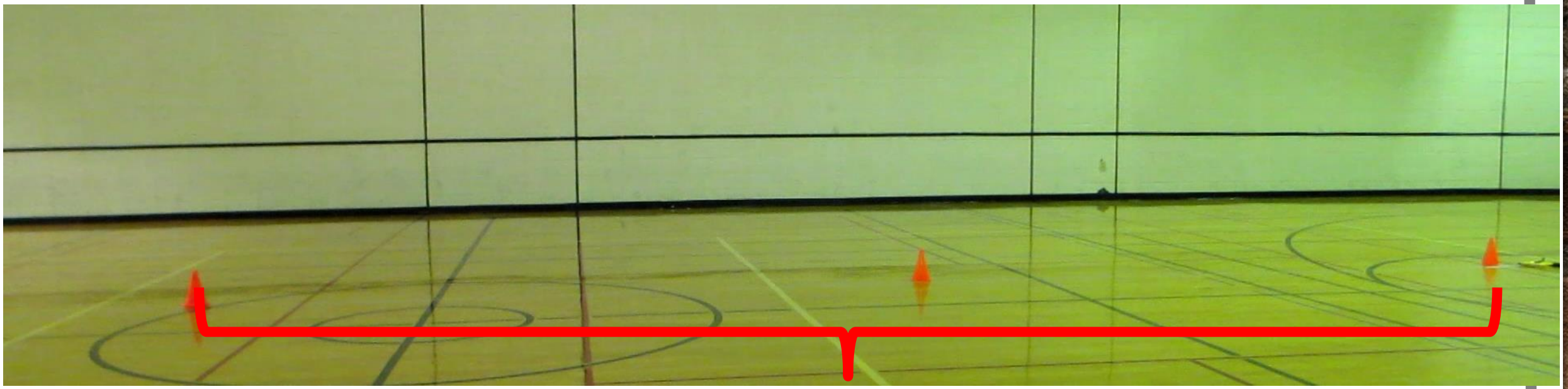
- Cleans (≤ 90° knee joint angle)
- Loaded CMJ_{vert} (≈10% BWT)
- Loaded CMJ_{horz} (≈10% BWT)
  - Athlete's ability to absorb bar load or landing

PURPOSE OF DECELERATION - LOCOMOTIVE

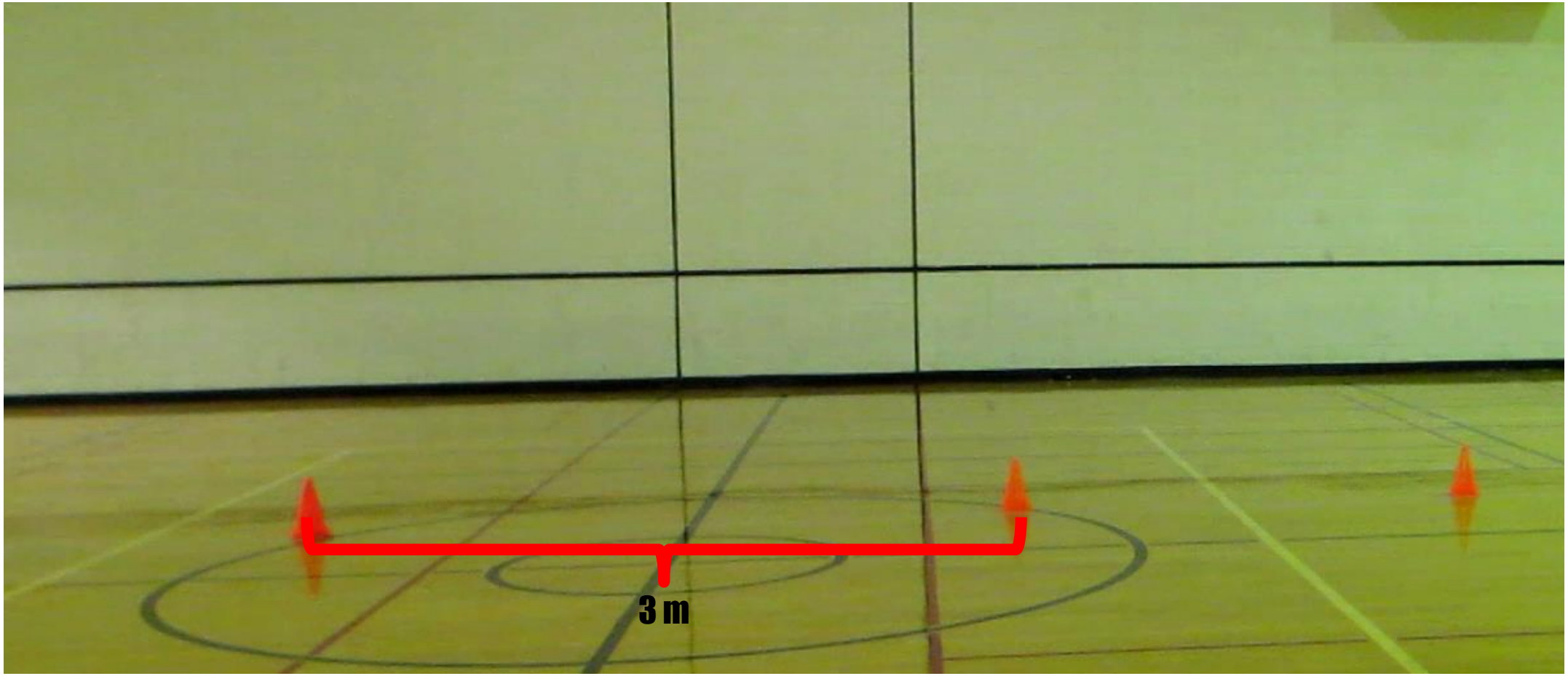
- **Stopping**
  - Gradual
  - Rapid
- **Change of Direction**
  - Reverse Directions
  - Large angle COD — Angle > 120°
  - Moderate angle COD — Angle 119-91°
  - Small angle COD — Angle < 90°



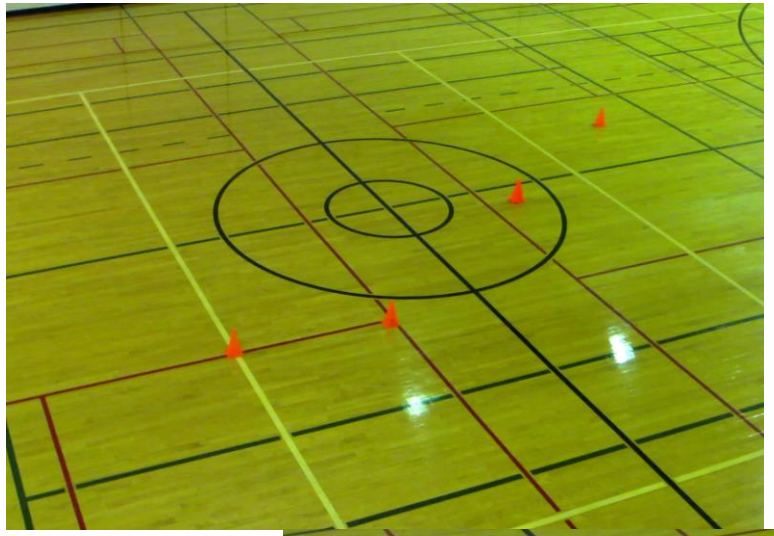
DECELERATION – LINEAR GRADUAL



DECELERATION – LINEAR RAPID



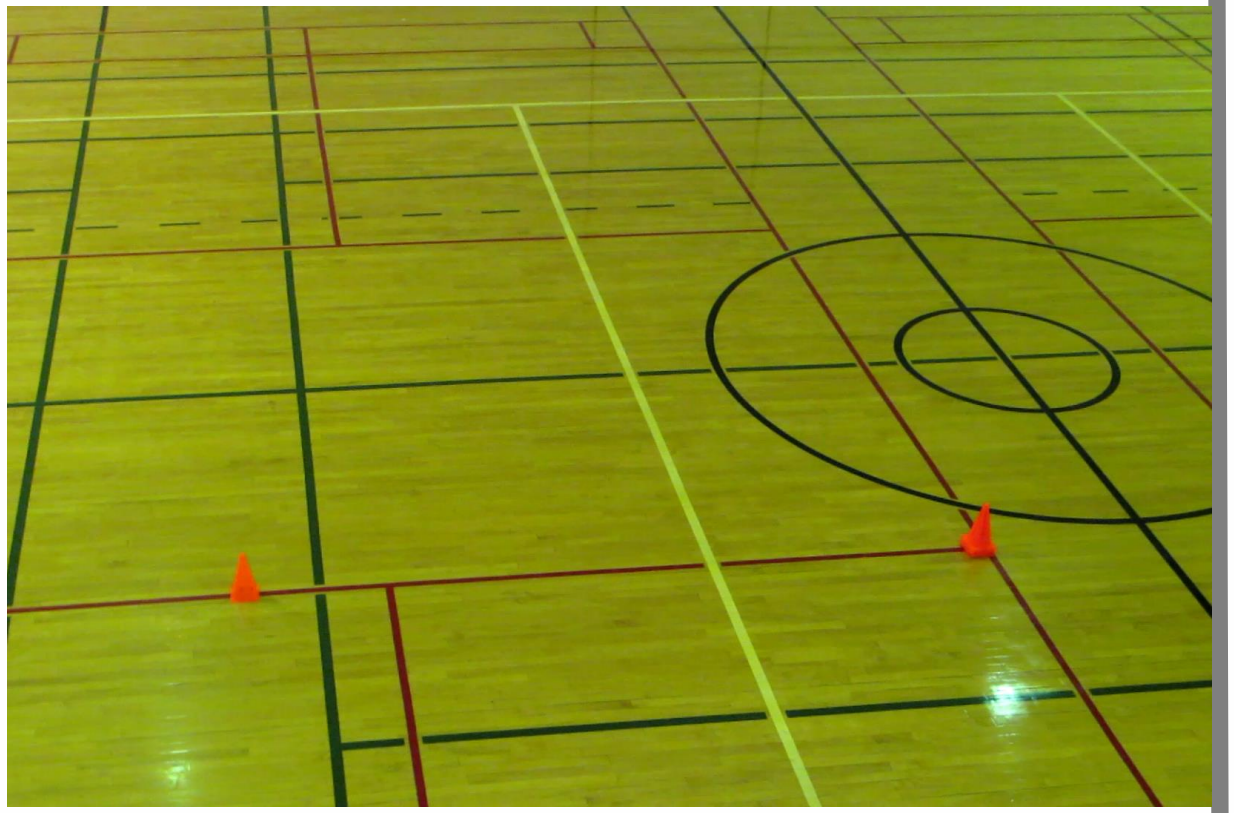
DECELERATION – CHANGE OF DIRECTION



- The > COD angle = > eccentric loading
- Consider the influence on DOMS
- Progression:
- Small COD angle → Large COD Angle
  - Consider initial acceleration distance
  - Second acceleration distance

DECELERATION – REVERSE DIRECTION

- Determine the deceleration:
- Load & accelerate or Spin & stop
- Perform absent of sport skill 1st
- Initial acceleration distance
- Change on a mark or opponent



DECELERATION: PROGRAMMING

Sets: 2 or 3 may increase to 5 or 6
Reps: 2 initially then add as technique improves to 4 to 6
Intensity: 40% - 80% 1-RM (near maximal loads acceptable with efficient technique)
Goal: Landing in deep triple flexion

STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

- Develop ability to decelerate external load bilaterally
- Requires proper landing mechanics

STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

- Volleyball
- Basketball
- Softball + Baseball

Split Jerk

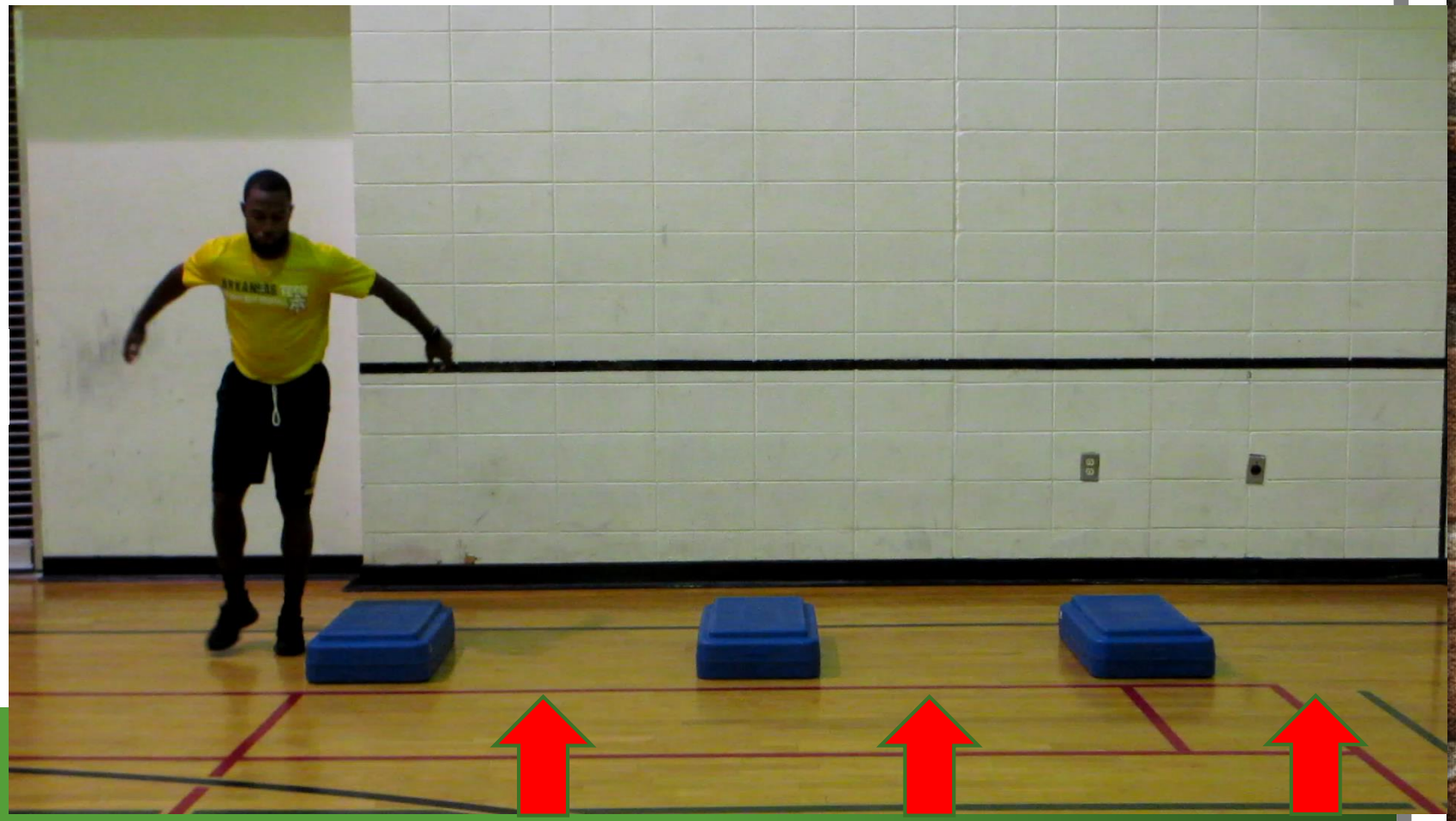
- American Football (WR, DB)
- Football (aka. soccer)

STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

- Box and obstacle jumps
- Applicable to sports with landings
- Adjust exercises to be performed with hops

STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

- Short ground contact time
- Hold landing
- Emphasize SSC
- Bilateral to unilateral (e.g. Hops)



STRENGTH AND CONDITIONING EXERCISES FOR DECELERATION

<u>Posterior Chain Development</u>

- Good mornings
- Stiffed-legged deadlifts (RDL)
- Glute-hamstring raises
- Reverse hyperextensions
- Loaded hip thrusts

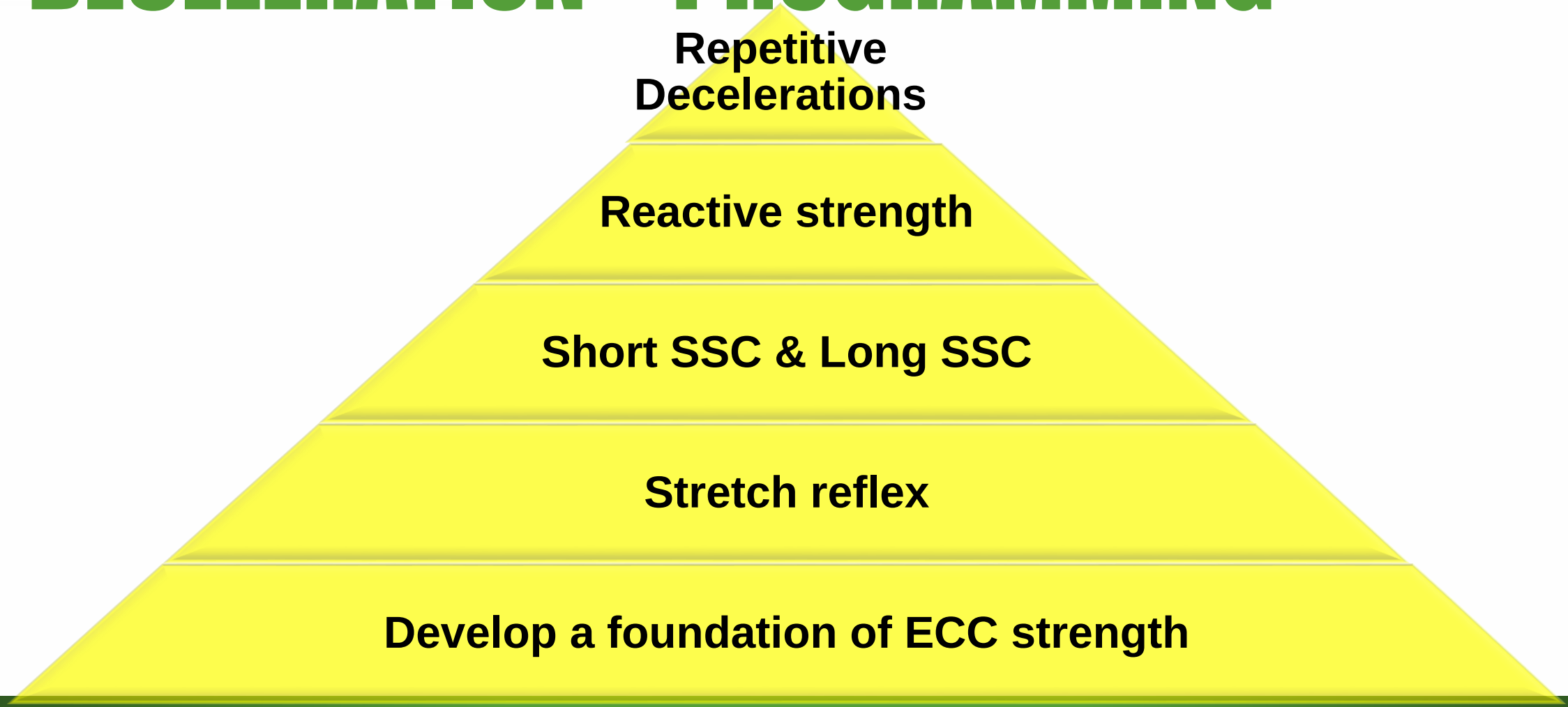
- ➢ Strength
- ➢ Strength-endurance
- ➢ Progress to higher velocity execution

DECELERATION – PROGRAMMING

- Post- and off-season
- Start with small volume
- Incorporate in DWU
- Add during ECC block
- Provide 1 or 2 cues

- STR-SPD Deceleration focused exercises 15-50 reps / session
- Linear stop 5 (Sprint Vel_{pk})-20
- COD 10 (large ∟) -30 (small ∟)
- RECOVERY! Minimize DOMS!

DECELERATION – PROGRAMMING



Lakomy, J., and D.T. Haydon. The effects of enforced, rapid deceleration on performance in a multiple sprint test. *J. Strength Cond. Res*. 18(3):579–583. 2004.
Woolley, B.P., Jakeman, J.R., and Faulkner, J.A. Multiple Sprint Exercise with a Short Deceleration Induces Muscle Damage and Performance Impairment in Young, Physically Active Males. *J Athl Enhancement*. 3:2, 2014.

DECELERATION – PROGRAMMING

- Posterior-chain strength and power
- Hamstring muscle groups, gluteus maximus
- Lower-leg strength, ankle exercises
- Triple flexion at increasing velocities
- Strengthen the trunk musculature

Podraza, J.T. & White, S.C. Effect of knee flexion angle on ground reaction forces, knee moments and muscle co-contraction during an impact-like deceleration landing: Implications for the non-contact mechanism of ACL injury. The Knee 17: 291–295, 2010.
Shin , C.S., Chaudhari, A.M., & Andriacchi, T.P. The influence of deceleration forces on ACL strain during single-leg landing: A simulation study. Journal of Biomechanics 4:1145–1152..2007.

DECELERATION - PROGRAMMING

Basic Skill	Intermediate Skill	Skill Mastery
Linear Long Stop	Sprint 10-30 m Stop	Sprint +30 m Stop
Jumps hold Land	Jumps	Repeat Jumps
Drop Landing	Depth Jumps	Depth Jumps w/sprint
Stop – COD	10-5-10; Shuttles	10-5-10; Shuttles
Lateral Leap Hold	Large Angle COD	Small Angle COD
Hops with Hold	Repeat Hops	Repeat Hops

DECELERATION – PROGRAMMING

Off-season Women's Soccer Example

Day 1	Day 2		Day 3	Day 4
Hang MT Cleans	**Loaded CMJ_{vert}**		**BWD MB Throw**	**Hang MT Cleans**
5x2 @ 85%1RM	4x4 @ 10-30% BSQ1RM		8x	5x3 @ 80%1RM
DB Split Jerk	**Lateral 6" Hurdle hops**		**Bounds**	***DB Incline Bench Pr.**
3x5RM	3x6		3x6	3x8-12RM
Front Squat	**Multi 6" Hurdle hops**		**W-pattern agility**	***Inverted Row**
4x6-8RM	3x6		4x	3x12-15 Rep Max
1-arm Row	**Multi-box Jumps**	**OFF**	**L-pattern agility**	**Step-ups w/band ECC**
3x8-12RM	4x3		2xL + 2xR	4x6-8 ea. leg
SLDL (RDL)	**Cycle Split Jumps**		**Angled sprint <15m**	**Loaded Hip Thrust**
2x8-12RM	2x8		2xL + 2xR	2x8-12 @ 50% BSQ1RM
Ancillary (superset)	**Lateral Leap and Hold**		**Sprint 10m**	***Ancillary (superset)***
T-V-W 2x15	2x8		5x	**T-V-W 2x15**
1-leg heel raise 2x15				**1-leg heel raise 2x15**
Trunk Circuit	**MB Tempo**		**MB Tempo**	***Trunk Circuit***
Rotational	**2-3x30s-1min**		**2-3x30s-1min**	**Static**

DECELERATION – COACHING CUES

- “Get low”; “Lower your body”; “Drop your hips”
- “Plant outside foot”; “Load your leg(s)”; “Push knee(s) out”
- “Punch with your arms”; “Turn and reach”
- “Head and chest up”; “Focus on your direction”
- “Absorb with your leg (muscles)”; “Hips back”

THANK YOU FOR YOUR ATTENTION & TIME.

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