The 40yd Dash: Bridging the Gap between Injury Prevention and Performance Enhancement

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Acknowledgments

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The 40 yard Dash: Background and importance

- Chris Johnson had a breakout senior year at East Carolina, rushing for 1,423 yards and averaging 6 yards per carry in 2007. But he wasn't considered a first-round talent until he clocked a 4.24 in the 2008 combine.

- The origin of timing football players for 40 yards comes from the average distance of a punt and the time it takes to reach that distance. Punts average around 40 yards in distance from the line of scrimmage, and the hangtime (time of flight) averages approximately 4.5 seconds. Therefore, if a coach knows that a player runs 40 yards in 4.5 seconds, he will be able to leave the line of scrimmage when a punt is kicked, and reach the point where the ball comes down just as it arrives.

Presenting the Problem:

Wanting to measure 40 time but hesitant due to risk of injury

- Reasons for using the 40.
  - A major metric in evaluation of HS and College talent and predictor of on field production.
  - THE metric for measuring top end speed / acceleration
  - Basis for comparison. Individuals on the team, vs. other teams, combine athletes. Motivation.
  - If you can run multiple full speed 40 yard dashes, you're ready for spring ball / camp.
- Alternate means of data collection
  - Some use 10 – 20yd dash to predict 40 and minimize risk of hamstring pulls.
  - Some watch game film and predict : NFL Scouts

Risk vs Reward

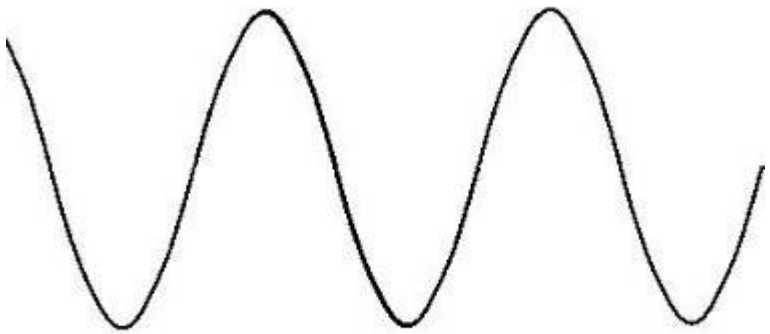
- Account for 13% of Football In-Season injuries.
- Timing usually takes place headed into spring ball or fall camp. These are crucial evaluation times for the position coaches / players. Can't have student athletes sidelined with injury.
- Depending on severity of injury, can delay athlete's strength and conditioning development due to necessary modifications for injury.
- Importance placed on 40 can lead to false metrics reported: Rolling starts, hand time stopped early, just generally exaggerated times being reported to boost confidence or illusion of speed.

Mechanisms of Hamstring Pull

- Mechanism of injury
  - Shortened optimum muscle length
  - Lack of flexibility
  - Strength imbalance
  - Insufficient warm up
  - Poor lumbar posture (hip flexors)
- Excessive strain in eccentric contraction instead of force
- Generally occurs during late swing phase and late stance phase of sprinting
- Arm swing dictates leg swing. Mobile shoulders are crucial to sprint mechanics. Improper arm mechanics/fatigue can lead to improver leg swing.

Breaking force vs acceleration

- If leg strikes out in front of the body this is called a breaking force (slows you down) and must constantly be overcome.
- Heel strike out in front of the body is not only a breaking force but you are excessivly loading the hamstring in an elongated position.
- Hint, that's why you need a minimal level of hamstring mobility.



Train for Early Heel Recovery vs Late

Mechanics to Maximize Speed and Minimize Risk of Injury

- Leg cycle needs to be quick to accelerate and maintain speed. Heel should remain High and tight.
- Cycle step should be trained at optimal speeds. I.e. No leg curls.
- Late heel recovery = foot drop and oblong leg swing.
- This places extra load on the hamstring = more fatigue.
- More fatigue = muscle tightens to protect itself.
- Pulls happen in the elongated position, hence that is how strength work is done. RDL / Hip Ext.

Breaking the 40 Down

Start

- Start – Steps off start line. 1, 2, and a half. Then kneel. Hands just out side shoulders, Arms Straight, Shoulders infront of your hands. Head is heavy and neck is relaxed.
- On set, hips up, opposite hand to hip. 90-95% of weight on lead leg.
- Go, explode off the line with a low flat 1st step. Leg drive is complimented by and exaggerated arm drive. Down hand gets thrown straight back, hand by the hip "upper cuts" over your head.
- Dorsi flex the toe, drive out with a ridged mid line, if you break you lose force production
- Should have longer ground contact time early on in the sprint.
- Longer you are in contact with the ground, the more force you can produce

Common Start Faults

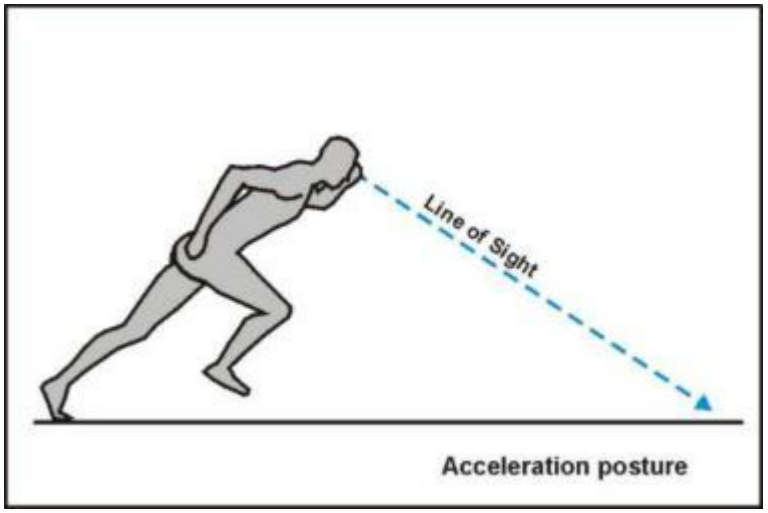
Stance

- Shoulders aren't over their hands
- Back hand too high
- Head isn't down
- Foot placement

Start

- 1st move, pick their down hand straight up. Leads to standing straight up
- Pop up out of there stance, then fighting to just not slow down
- Short first step
- Incomplete 1st arm split
- Rounded back – improper angle.

Transition



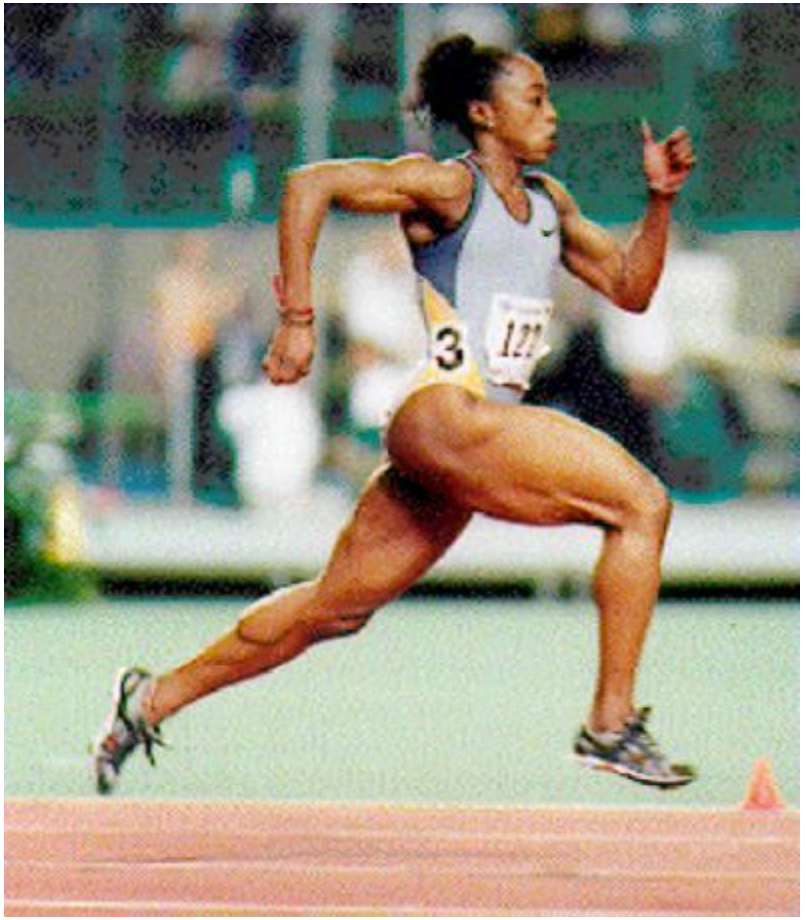
- An ideal departure angle is ~45degrees. Head is looking down and infront of you. Not forward and not at your feet. Drive phase continues in the 40 for 10-15yds.
- Begin Transition into focusing on turnover “leg cycles”. Gradual raise of your gaze. As eyes and head comes up, hips come forward
- Ground contact time should decrease as you accelerate.

Common Transition Faults

- Keep Head down too long. Running upright with head down
- Fight the transition. Leads to poor posture
- Hips don’t come forward (get tall) as eyes come up

Top End

- Mechanics/Mobility – drills for each
- Emphasis is now on tall posture, neutral positon, EARLY HEEL RECOVERY, ARM SWING
- Stride Frequency increases while maintaining Stride length.
- Knees up, toes up, hammer back with elbows
- Shoulders down and back
- Elite sprinters are off the ground 51% of the time, literally flying.



Common Top End Faults

- Shortened arm swing = shortened stride length
- Lazy toes = late heel recovery
- Reaching with feet versus driving the knees

Offseason Overview Within Time Constraints

- **<u>Weight Room</u>**
- Jan – Hypertrophy/ work capacity
- Feb- Strength/absolute
- March – Power-absolute/Test

- All of the above has to happen in 8-9 weeks. Leaving 2-3 weeks for each phase.

- **<u>Field Work</u>**
- Jan – Starts/Acceleration
- Feb – Transition/Top End Speed
- March – Over speed/Test

Oh yeah, Agility / Conditioning, too.

Offseason Begins with evaluation

- Hamstrings
- Hip Flexors
- Anterior Shoulders
- Additional screening done as well. Used to identify faulty movement patterns in athletes. Info tells us glaring needs for team as well as individuals.
- Done at beginning of offseason. Takes 1 day to get entire team evaluated and training maxes recorded.
- Corrective movements are built into warm up and super set with weight training.
- Doesn’t matter how good of a coach you are. If they can physically hit certain positions. They wont hit them.

Hamstring / Hip Flexor Mobility Screen

- Screen is originally done with both legs straight. Athlete flexes right and left quad, dorsi flexes both ankles, then flexes right hip as far as possible while keeping left leg straight.
- 90 degrees of flexion is a pass.
- Initial degree of flexion is noted.
- Next, the athlete repeats the test. Only this time the left leg is bent to relax the hip flexor and the previous test is repeated to identify the unimpeded range of motion of the hip flexor.
- If there is a significant difference between the 2 tests, athlete is identified as hip flexor being a potential limiting factor for top end mechanics.

External Rotation / Anterior Mobility

- The athlete leans against the wall. Head, upper, mid, and lower back all make contact with the wall. The elbows are abducted away from the body until they are parallel with the floor. Next both elbows are flexed at 90 degrees. Palms face eachother. Then the athlete externally rotates at the shoulder as far as then can. If they can get their thumbs to the wall while head, shoulders and back maintaining contact, that's a pass.
- If test is failed, suggest athlete will have limited arm swing mechanics which will hinder leg swing during sprinting.

Make Speed Development a Priority

- Improve relative to where you come in.
- Mechanics can and should be improved. Improved mechanics lead to improved speed potential (increased stride length and frequency) and reduction of overuse injuries via improved movement efficiency.
- Can't just spend a few weeks on it a year (2 week speed school). It needs to be addressed daily.
- Keep data on mobility, strength, speed and visual feed back to ensure Year to Year process.
- Tailored to individual physical preparedness
  - Where you come in. Have to be able to evaluate and know what you're looking for/at.

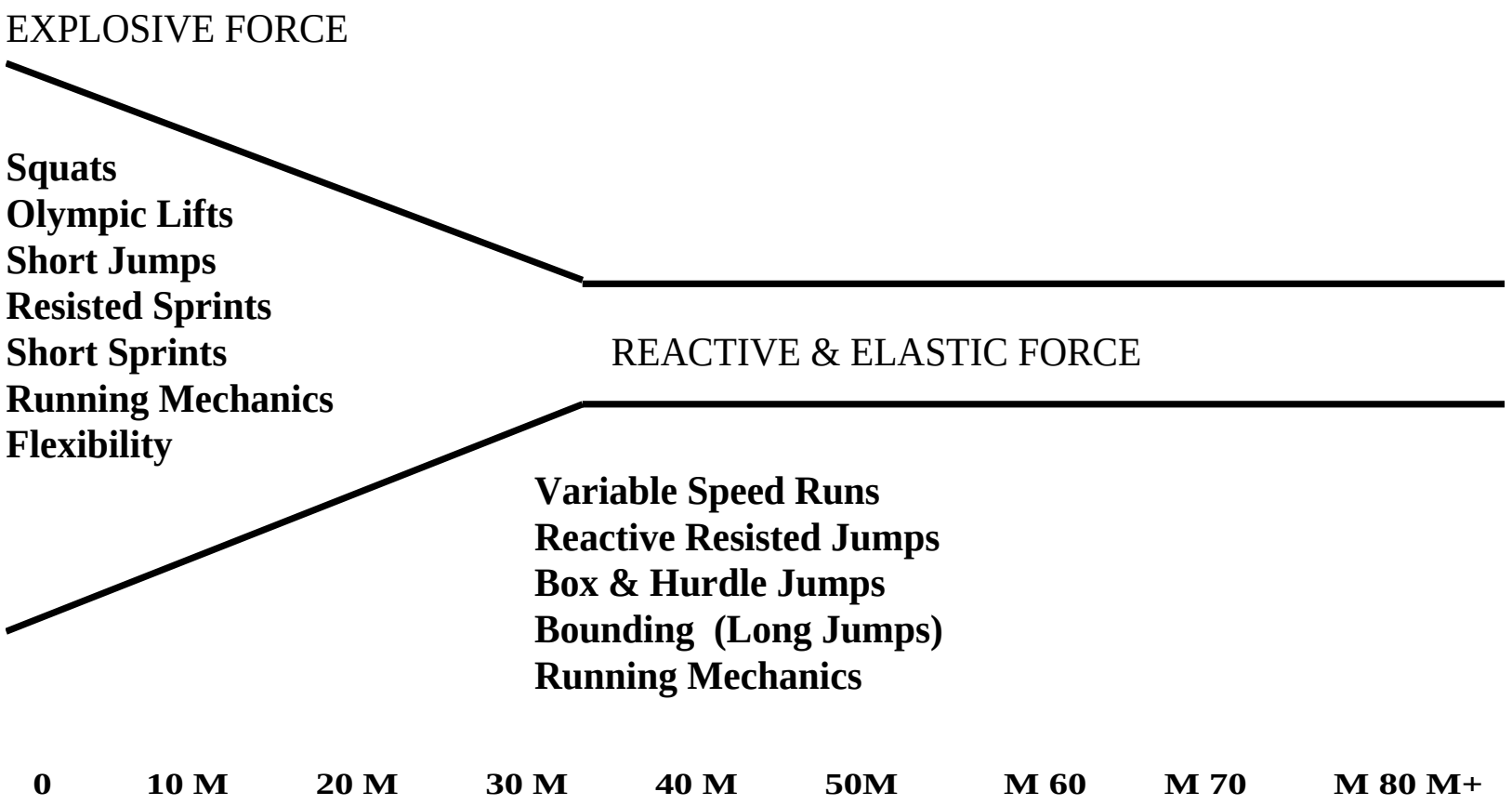
Every Conditioning Day Begins with the Following Warm Up:

- Walking Mobility
- Awkward Butt Kicks – varying tempos
- Butt Kicks – varying tempos
- High Knee Runs – varying tempos
- High Knee Karioka
- Shuffles – varying tempo and change
- Drop Skips
- Stider work (between 100 – 10yds) is performed to further warm up the athletes but to also practice top end speed mechanics.
- Plyometrics – Hurdle hops / Power skips

Addressing Speed Potential

- Improved mobility is where you increase speed potential. Improved mobility leads to being capable of hitting better positions. Better positions lead to better acceleration/top speed. It's our job to ensure our athletes realize that potential.
- You have to be able to objectively evaluate an athlete. Not just the number on the stop watch. Train your eye to be able to evaluate mechanics.
- Improving strength and power helps speed also (10-20yds). However, if then necessary positions aren't hit following an explosive start, much of the speed built up is lost.
- By addressing strength, mobility AND mechanics you can improve start, stride length, then train to improve stride frequency and positions as they relate to acceleration. This is how you truly realize an individuals potential and see year to year progress.
- Magnitude of Force Production – Squats, Lunges, RDL, H.Ext, Step Ups
- Rate of Force Production – Cleans – Plyos

CARLO VITTORI'S SPEED CONTINUUM



Magnitude of Force Production / Strength Work

- Lunges
  - Open up hips, don't bounce knee off the ground
  - Positive Shin Angle to mimic acceleration
  - Stiff Legged Runs
    - Great prehab/conditioning

  RDL
    - Feet hip width apart
    - Soft knees
    - Balance on the feet

- Step Ups
  - Mimic Cycle Mechanics
  - Positive shin angle

  Squats
    - Front and Back with positive shin angle.

  Back Extention.
    - Strengthening the Hamstring in an elongated position

Everything we do is geared towards movement efficiency. Making better athletes.

Rate of Force Production – Stride Frequency

Plyos – Hurdle Hops, Box Jumps, Power skips

Oly Lifts – Increased mobility for sprinting carries over to weight room, carries over to the field. Can train harder into the season, maintaining joint integrity and force production later in the year.

On Field Drills

Acceleration Drills

- Starts regular and assisted.
- Counting 7th step
  - Don't over stride to get further.
  - Stay in your mechanics. As mobility, strength improves, so will 7th step
  - Dot drills have you reach – don't reach. Reaching = breaking force. Dots all the way are where You "SHOULD" be
- Doesn't matter if you're Bear Bryant. If the kid cant physically get in those positions, its not going to happen.
- Longer you can stay in your drive phase, more speed you build. Usain Bolt slow off blocks then walks them down.

Resisted sprints

- Goal is to build strength and reinforce mechanics in the drive phase. Lean and strong core.
- There should still be a level of speed. Don’t overload the movement ie heavy prowler push. Usually work in the 10-20% of bodyweight range. Research shows improvement with as much as 43%
- Watch for back angle. Maintain neutral spine.
- Speed is the goal. Mechanics get you there.
- Sled vs. Parachute – constant angle of resistance, parachute pulls you up and out of your drive phase.

Assisted Sprints

- 1-2 Sec delay between lead runner and trail runner.
- Ideal tension is 15% assistance. What does that mean… 10-15% greater than unassisted top speed.
- Downhill sprinting works as well. 7-10% grade.
- Goal is maintained mechanics with increased rate.
- Watch for back arch/ late heel recovery. Happens with too much resistance
- Emphasize arm swing and stay relaxed to go faster.

Stiff Legged Running

Example of Sprint Workout

- Walking Mobility
- Dynamic Warm Up
- Striders – 4-6 = 100-10yds
- Power Skips – 4 x 3 each leg
- 10 yd Starts x 6
- Resisted 30’s x 6
- 30yd Sprints x 3
- Stiff Legged Runs – 3 x 30 yds

Periodization: Weight room vs Conditioning

- Medium, Medium Heavy, Light, Heavy.
- On field and weight room are in sync. No part of your body is an island. Only have 1 nervous system.
- Conditioning, just like lifting has to have progressive overload and recovery built in to see continued progress and adaptation. Monitor volume and intensity.
- Written in pencil vs ink. This is where the art of coaching comes into play.
- If someone is getting tight, work on high knee mechanics and striders on the side until individual work capacity improves.