



SPEED DEVELOPMENT
for
ATHLETES

Study Guide

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Thanks to...

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INTRO

About the author...

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Education

Cal State Long Beach - Bachelor of Science in Kinesiology

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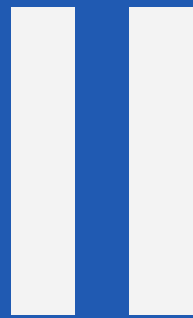
Certified Personal Fitness Training - National Exercise & Sports Trainers Association

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When I set out to make an online course I think about how my education can be different than the rest. Growing up I have always been fascinated and motivated by what I saw on the big screen. While my talents with cinematography or story telling are nowhere close to the likes of Christopher Nolan or JJ Abrams, my hope is that their inspiration has led to my overall vision of making new entertaining online education. I won't be physically shaking the camera or knowingly leave any cliff-hangers, so don't worry about looking for spoilers, but hopefully my education keeps you watching and learning.

Enjoy and always look for motivation in anything....

-Tyler



Structure & Makeup

Structure and Makeup of Speed Development

Muscle Fiber Types

Greater percentage of fast twitch muscle fiber than _____ and _____.

Structure

- Actual _____ of the muscle may influence speed.
- Kumagi et al.(2000) compared sprinters who could run 100 m in under 11 seconds with those who ran it between 11 to 11.7. They found that the faster sprinters had greater fascicle length (the lengths of bundles of muscle fibers running from proximal to distal tendons), which accounted for an almost 22% faster shortening velocity
- Abe et al. found similar results in sprinter vs 10-k runners and marathon runners
- Smaller _____ angles (degree of alignment with the long axis of the muscle)
- Research is not sure how trainable these are...

Flexibility

- Allows athlete to move limbs through _____ ROM without impedance
- Fluidity
- Efficiency – increase in stride length and frequency
- Stretching Routine

Dynamic vs Static

- _____ will have the greatest crossover to running

Fatigue

- Will interfere with a muscles ability to _____ quickly.
- Interfere with _____, which leads to decrease in technique.

Technique

- Makes the runner more _____ and faster
- Prevents injuries that could result from excessive loading to the tissues associated with bad form

Stride Length and Frequency

- $SPEED = \text{_____} + \text{_____}$.
- Hunter et al. (2004) showed a negative relationship between stride length and stride frequency (i.e. athletes with a greater stride rate had a lower stride length and vice versa), but also showed that when comparing sprinting trials (near maximum to maximum), stride length remained constant whereas stride frequency increased.
- For each individual athlete there is an optimal relationship between the two; both qualities should be trained.
- High-speed treadmill sprinting, elastic cord towing, and downhill sprinting are examples of over-speed training that are intended to improve stride frequency. The training method used to improve stride length is resisted training that includes the following: resisted sled training, weighted vest, uphill sprinting, strength training and plyometrics.

Sprinting Technique

Two phases – Driving Phase & Recovery Phase

- Driving Phase - Begins when the lead foot lands on the outside of the forefoot just in front of the athlete's center of gravity (i.e. the athlete's hip). The foot is driven to the ground by the _____

_____ muscles. It is important for the quadriceps to fire as the foot makes contact with the ground to keep the knee from flexing excessively, which would dissipate elastic energy. The ankle should be dorsiflexed with the foot's big toe pulled up, the combination of which will allow for the storage of elastic energy to be maximized to help with propulsion later. Once the toes leave the ground then the driving phase has ended.

- Key muscles – _____ and _____.

Recovery Phase

- As the foot leaves the ground, the athlete should immediately dorsiflex the ankle to approximately 90 degrees while pulling the big toe up. As this is being done, the athlete should flex the knee and quickly bring the heel up toward the hips/buttocks.
- “_____” – allows leg to be swung forward
- As the heel is brought to the hip, the leg will be swung forward. As the athlete is stepping over the opposite knee, the athlete's leg will naturally begin to unfold.
- Legs should be driven back down to the ground from the hips, which ends the recovery phase.

Three Phases – _____ Phase from 0 to 10 m, Transition and then maximum velocity phase from 36 to 100 m during a 100 m sprint

- Mero (1988), acceleration phase was first 30-50 m followed by a maximum velocity phase and a phase of deceleration
- Many sports often do not have a _____ component or rare, and acceleration training could be more applicable.
- Acceleration and maximum velocity are separate components and must be developed separately
- Acceleration involved technique and force production capability of the body, specifically the _____.
- Way to train include: weight training, plyometrics, assisted and resisted sprinting techniques
- When you think about it, many athletes have to accelerate from a prone position or crouched position, from moving sideways or backwards, from a single leg stance or a pivot.
- Force capabilities of muscle is key!

Arm Swings

- Help with _____ and to help provide _____. Should be swung backwards from the shoulder powerfully. If the arms are swung back forcefully enough, the stretch _____ at the shoulder will swing them forwards. Hands should be swung from the hips to the height of the shoulders, without crossing the midline of the body.
- Generally requires 12-15m of accelerating.
- Improve with coordination.

Acceleration vs Maximum Speed

- Running mechanics different over the first 12-15m
- Athlete is increasing velocity and stride length
- As stride length increases, the foot will be making contact with the ground initially _____ the athlete (depending on starting position), then it will make contact in front of but closer to the athlete than during maximum velocity, which will mean a _____ shin angle during foot contact,
- Athlete should focus primarily on _____ mechanics (high knee, dorsiflexion) and a little backside mechanics (plantar flexion, heel to hip). Body is too low for backside mechanics.
- Not many sports that athletes will sprint more than 12-15 m linearly; Usually _____ speed.
- So should athlete practice more than 12-15 m? Depends on the athlete. What are the demands?
- Less than 12-15m, frontside mechanics will help; if more than maximum-velocity running tech-

nique

Biomechanics of Acceleration Phase

Kinematics

- Sprint velocity is a product of step length and step frequency.
- Both increased to enhance velocity during the _____ phase.
- Each step comprises a _____ and a _____.
- Stance Phase – The time that the foot is in contact with the ground during the stride cycle
- Swing Phase – Ipsilateral foot strike to ipsilateral toe-off.
- Acceleration phase of sprinting is characterized by a relatively long stance phase as the runner creates _____ to generate velocity.
- The stance phase comprises _____ and _____.
- Both varied during different components of sprinting.
- Acceleration phase the stance phase is largely made up of propulsive component with minimal braking forces at the foot.
- Maximum Velocity Phase there is more braking .
- Mero (1988) saw that the braking phase was only 12.9% of the stance phase during acceleration.
- Mero et al. (1992) found that during the first few strides in sprinting the bodies COG undergoes a posterior shift, from an anterior position at foot strike to a position posterior to the point of foot strike.
- Athletes sprinting technique is determined by the angles of the trunk, thigh, knee and ankle.
- Frishberg (1983) reported a foot strike thigh angle of 29.9 at 50m from a sprint start
- Letzelter et al. (1995) mean thigh angle of 22.6 at 30m
- Literature is inconclusive. Specificity?
- Williams (1985) reported strike thigh angles ranging from 20.8 degrees to 30 degrees and stated that thigh angle did not seem to change appreciable with increased running speed.
- Mann and Herman (1985), more efficient sprinters terminated the nonproductive later part of the stance phase and began _____ more quickly.
- Hay (1985) believed that the thigh should move through as great a range as possible and that failure of the thigh to do was common fault.
- Knee flexion at the foot strike 10 degree to 30 degrees.
- Following foot strike the knee flexes further to absorb the energy associated with the ground reaction forces generated at foot strike.
- Knee flexion as foot strike is greater during the acceleration phase when compared to maximum velocity sprinting.

Kinetics

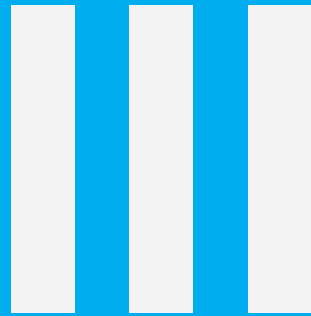
- _____ propulsive forces during the first ground contact have been reported to be 46% greater than those observed once maximum velocity is achieved. Vertical propulsive forces have been shown to be similar during the acceleration phase and maximum velocity phase of sprinting.
- Plamondon and Roy (1984) found that _____ braking forces decreased between steps 1 and 12, whereas horizontal braking forces increased up to the 12th stride, where they started to plateau.

EMG Activity

- Suggested that the _____ play an important role during the propulsive phase of stance, extending the thigh.
- Mero and Komi (1987) suggested that _____ activity during the propulsive phase of stance during maximum velocity sprinting was limited.

Structure and Makeup of Speed Development Answers

1. Distance runners
2. Untrained individuals
3. Structure
4. Pennation
5. Full
6. Dynamic flexibility
7. Shorten
8. Coordination
9. Efficient
10. Stride Length + Stride Frequency
11. Hip Extensor
12. Hip and knee extensors
13. Shortens the lever
14. Acceleration
15. Maximum Velocity
16. Lower Extremities
17. Balance
18. Momentum
19. Reflex
20. Behind
21. Lower
22. Front side
23. Change of direction
24. Acceleration
25. Stance phase
26. Swing phase
27. Power
28. Braking
29. Propulsion
30. Trunk, thigh, knee and ankle
31. Recovery
32. Horizontal
33. Vertical
34. Hamstrings
35. Knee extensor
36. Vastus Lateralis
37. Vastus Medialis



Application: Technique Drills

Application: Technique Drills

Technique Drills

- Provide different training stimuli and hence different adaptations
- Used to break the sprinting motion down into more manageable components.
- Slower speeds should be mastered (proper progressions)
- Eventually the athletes can _____ the techniques of the parts (drills) to the whole movement (maximum speed sprints depending on athlete).
- Drills: arm swing drills, ankling, heel kicks, high-knee drills, A drills and B drills

Arm-Swing Drills



- Arms act in opposition to the legs serving to prevent upper body _____, which leads to loss of balance and timing.
- Avoiding the arms crossing the midline.
- Contributes to _____ - _____.
- If the arms are driven back forcefully, the stretch reflex at the shoulder will recover the arms forward, which will also serve.
- Allows athlete to focus on other aspects.
- Elite sprints elbow angles 60 degrees in front to about 140 in back (Cissik, 2002).

Progressions

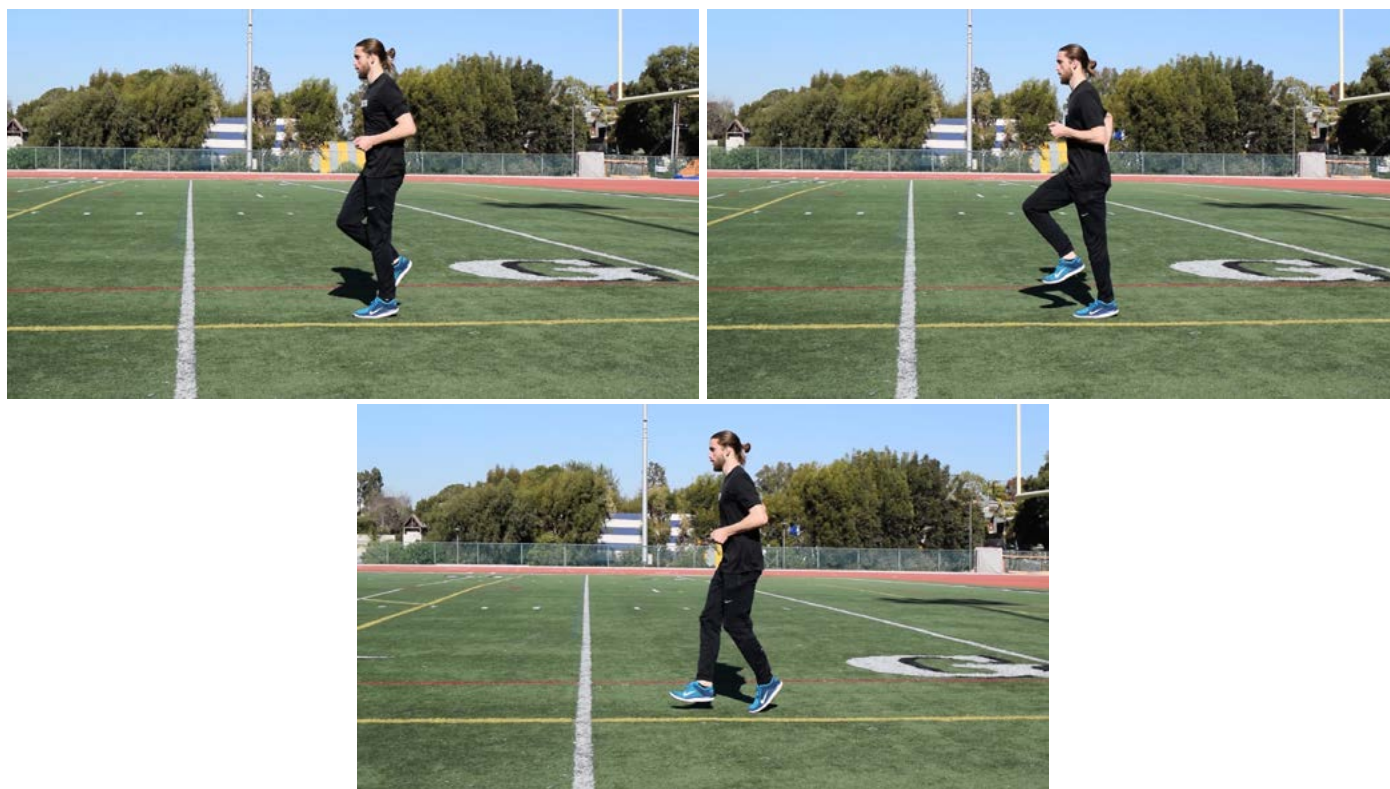
- Seated -> Standing
- Cues: sit tall, right hand next to right hip, left hand in front of left shoulder. When commanded, the athlete will drive the left arm backwards until the left hand is next to the left hip.

Common errors

- Athletes may not swing the arm from the shoulder. They may swing by locking the upper arm into place and only moving the lower arm. “_____” or “_____”.
- Athletes may allow their arms to cross the midline. Increases the upper body rotation. Focus on arm drives.
- Athletes may swing the arms too high or not far back enough.

NOTES:

Ankling



- Teaches how to lift the feet off the ground and how to put them down during sprinting.
- _____ time that the foot is spent on the ground.
- Minimizes power lost into the ground by creating a more stable ankle position.
- Minimizes chance of _____ which might be caused by poor foot placement.
- Optimal foot action should emphasize _____ as the hips pass over the foot to push the body forward. When the back foot breaks contact with the ground, it should immediately be “_____”. Casting refers to dorsiflexing the ankle to approximately 90 degrees while pulling the big toe up. The foot should remain in the cast position until it is again on the ground and the hips are passing over it. During ankling the foot will be driven forward from the hips, and the outside of the forefront will make contact with the ground and will pull the body over it.

Progressions

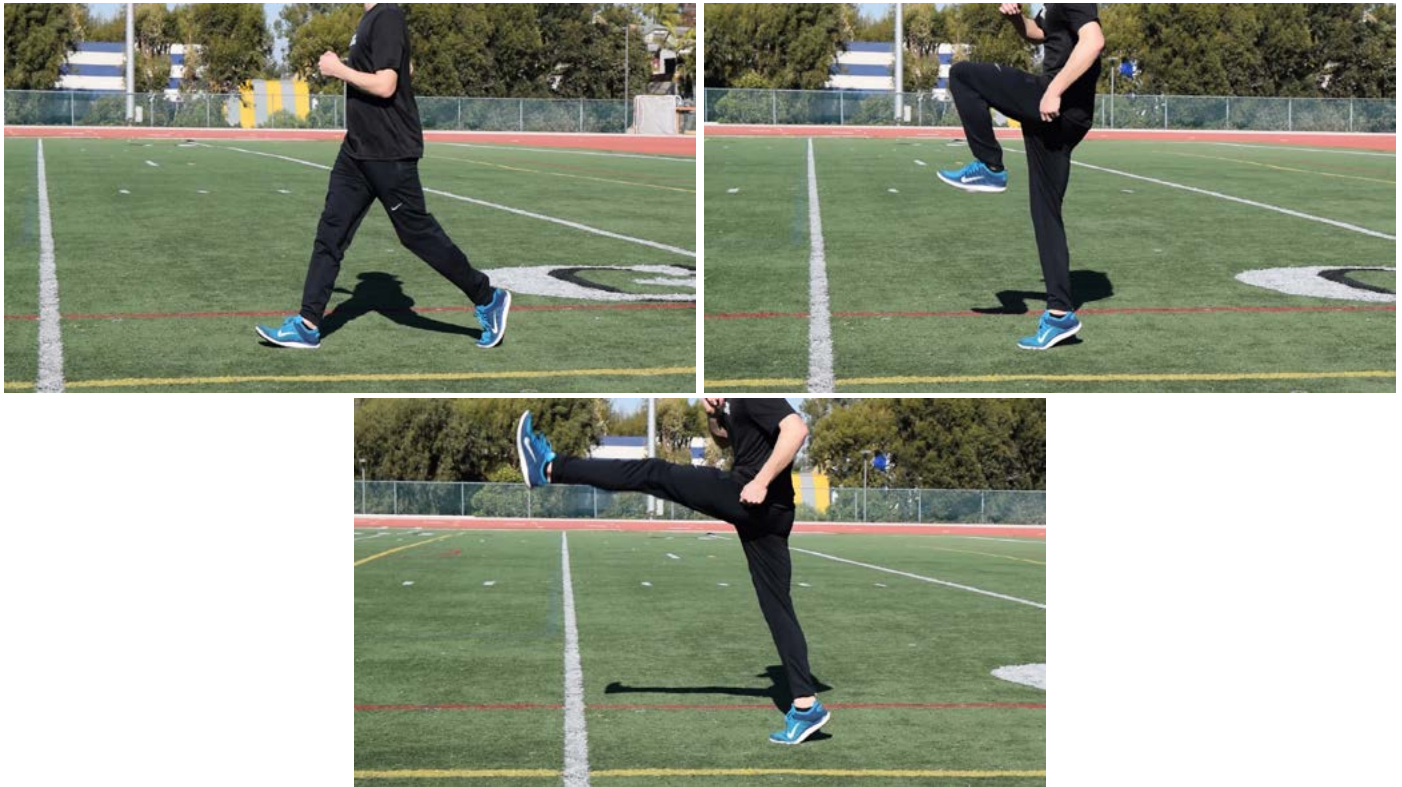
- Walking version is meant to be perfected and _____.
- Drill is performed walking, focusing on one leg at a time. With the legs stiff, move forward until the hips have passed over the right foot. As this happens, the right ankle will go into plantarflexion before the foot breaks contact with the ground. When the right foot breaks contact with the ground, it should be cast and driven forward from the hip. The outside of the right forefront will contact the ground and will pull the body over it.
- After you can go to straight leg bounding.

Common errors

- Running on toes or running _____ - ____ - _____. Causes balance problems.
- Can work on _____ movements

NOTES:

B Drills



- _____ drill that teaches the athlete how to exert more force against the ground.
- Athlete will perform the A Drill but as the leg is cycled forward, the _____ are relaxed. The combination of the relaxation of the hamstrings and the driving forward of the knee will cause the leg to extend the knee. The extended leg is then driven down (from the hips) much like the other drills

Progressions

- Start walking and one leg, move to alternating sides and then progress to drill with a skip
- Integrating arm motions
- Combing A Drills with B Drills

Common errors

- _____ lean while extending the knee can lead to over striding which causes the athlete to spend more time with foot contact
- Remember this drill is meant to carryover to sprinting and bad mechanics can effect maximum effort sprints

NOTES:

Application: Technique Drills Answers

1. Transfer
2. Rotation
3. Upper-Body Rotation
4. “Beating the drum” or “milking the cows”
5. Minimizes
6. Injury
7. Plantarflexion
8. Cast
9. SLOW
10. Heel-to-toe
11. Pawing
12. Ankling
13. Up
14. Shorten
15. Mobility
16. Down
17. Front side
18. Driven
19. Hip flexors
20. High-knee drills; heel kicks
21. Plantarflexion
22. Opposite
23. Advanced
24. Hamstrings
25. Posterior lean

IV

**Application: Stride Length & Stride
Frequency Drills**

Application: Stride Length & Stride Frequency Drills

Stride Length Drills

- Help improve speed or the _____ of a sprinter's stride.
- Need to determine the _____ stride length for athlete.
- Measure from greater trochanter of the femur to the floor.
- Females multiply by 2.3 to 2.5 for stride length; Males 2.5 to 2.7.
- Downside is if with many athletes this is time consuming, but can be incorporated into _____.
- Upside is that athletes can be put into groups once info is collected.
- Drills typically done at percentage of optimal stride length (60-105%).
- Too high of a percentage can lead to _____.
- Drills will be performed with _____ (cones, hurdles, tennis ball, etc) laid out at certain distances.
- Example: Athlete has a leg length of 36 inches. $2.5 \times 36 \text{ inches} = 90 \text{ inches}$ (optimal stride length). $60\% \text{ of } 90 \text{ in} = 54 \text{ inches}$ and $105\% \text{ of } 90 \text{ in} = 94.5 \text{ inches}$
- With elite athletes drills are performed at _____ distances to help train the sprinter to confirm to the new rhythm or stride.
- Macfarlane (1993), stride length drills should not be taken much farther than 20 markers and that a 5-m acceleration zone should be provided so that the athlete can reach his or her stride.

Stride Frequency Drills

- Improving frequency will lead to improvement in running speed
- Modalities: fast leg drills, resisted sprinting and assisted sprinting
- Fast leg drills allow the athlete to move a limb at a _____ speed than would normally be possible during the running motion
- Could lead to a _____ to sprinting, which would result in increased stride frequency and speed
- First performed with ankling. Example: right foot does ankling for three steps and then the left leg performs an A-Drill
- Once mastered move to second step A-Drill

Varying Distances and Intensities

- Technique drills alone are not a substitute for actual sprinting; just like stride-length and stride-frequency drills are not a substitute for sprinting
- Different motion and different speed

General Sprinting Guidelines

- Sprinting must take place at close to _____ speed because sprinting at submaximal speeds will alter running mechanics, stride frequency, and stride length
- Train slow be slow...
- Sprinting at high speeds is extremely taxing and requires optimal _____ between sessions (24-48 hours)
- Distances used for a sprint will depend on athlete and goal. If the desire is to train _____ speed then the distances will need to be greater than 50m. If the desire to train _____ then shorter distances will be used, 5-50m.
- Rest. Sprints are taxing on the system. Fatigue interferes with speed. Excessive fatigue will interfere with skill acquisition.
- More frequent training can be performed but should not be trained on _____ days.
- If not working with track athletes, then it is probably not necessary for an athlete to train the components of speed more than 3 times a week (Cissik, 2005)

- Ozolin (1978) the _____ is a nervous system pattern that develops as a result of long term use of similar training methods and training loads. A.k.a. leveling off.
- To break through use assisted sprinting methods, varied pace sprinting and resisted sprinting
- Unclear if speed barrier exists. Does it apply to non track athletes?

Varied-Pace Sprints

- Sprints that have several change in velocity during the sprint.
- Athlete runs at different speeds, the sprints give the athlete to recharge the _____ between maximal efforts.
- Sprints teach the athlete how to run relaxed at high velocities, which is important for tension which can cause the athlete to slow down.
- Sport specific. Resembles actions that can take place on field of play.

Drills

- Flying Sprints
- Ins and Outs
- Delayed Starts

Resisted Sprints

- Make sprinting motion more difficult; Develop _____.
- During the acceleration phase, there is a longer _____ (a large proportion of which is propulsion), greater knee and trunk flexion at foot strike, greater propulsive forces, and possibly greater EMG activity in the knee extensors
- Believed that the resisted-sprint exercises will _____ more muscle fibers and require more neural activation, therefore increase stride length over time.
- Modalities: Sled, tire, parachute, weighted vest, running uphill, running in sand or in water.
- Too much resistance may alter kinematics.
- Athletes will spend too much time on the ground, and unable to completely extend their hips because of too much _____ lean.
- Use sparingly with little resistance and during specific points in a program.

Guidelines

- Resistance should not _____ down the athlete more than 10%, anymore will alter running mechanics.
- Should be 15-20 m and have gradual release.
- Proper running _____ should be stressed.
- Food for thought? If you athlete rarely does maximum velocity sprinting in a performance, would it be beneficial to just do resisted sprints?

Limb Loading

- REASON: Involves the attachment of weights to the extremities of the athlete in order to provide overload while sprinting
- Likely to increase the moment of _____ considerably and increase muscle activity required during sprinting.
- Ropret et al.(1998) studied the effect of arm and leg loading on sprinting velocity, step length and step frequency. 0.66 on the upper extremities showed no significant improvement. 0.6, 1.2 and 1.8 had significant reduced sprinting velocity. Step length remained the same, so the decrease in velocity was attributed to a decrease in step frequency.
- Martin (1985), compared the effects of adding lead to specially developed shoes and loading the thighs by wearing lead weighted bike pants during treadmill running. Results showed that foot loading and thigh loading lengthened step length, increased recovery time of the _____ limb, and increased swing phase duration.

- Significant only with ankle joint loading.
- Illustrated how the increased inertia forces associated with distal loading resulted in a greater effect on running technique, especially in terms of decreasing step frequency.

Uphill Running



- Most popular and most cost-effective method of resisted sprint training.
- Reason: Uphill running will place increased load on the _____ muscles as athletes try to maximize step length. Research has shown that results have shown a shortened eccentric phase and an extended concentric phase for propulsion
- Thigh extensors thought to be important in the _____ phase of sprinting, the associated gain in strength is thought to increase the athlete's step length when sprinting on a flat surface.
- Dintiman et al.(1998) suggested that the hill incline should be at a _____ that does not compromise running form. Steeper inclines to improve the start and acceleration phases of sprinting (8-10 degrees in 2.5 -3.5 seconds) and progressively reduced inclines for longer sprint training. Greater than 3% is beneficial for developing hip extensor strength.
- Kunz and Kaufman(1981), biomechanics showed that inclined running resulted in a _____ in velocity of 1 m/s, no change in step length, and an increase in trunk-thigh angle. Concluded that uphill running might result in longitudinal adaptations, increased step length and shortening the stance phase during during sprinting on a flat surface.
- Paradis and Cooke (2001) analyzed sprinting up a 3 degree slope. Found that velocity was significantly _____ when sprinting uphill compared to sprinting on a flat surface. Primarily attributed to a decrease in step length. Changes in body position between sprinting uphill and on a flat surface. Trunk flexion was significantly increased, and the shank angle (the angle between the lower leg and the running surface) was reduced at both foot strike and toe-off. Thigh-to-thigh angle (the angle between the right and left thigh segments) was significantly decreased at toe-off. Suggested these kinematics changes resulted in an increase in the contribution of the propulsive phase to the stance phase.

Resisted Towing



- Sleds and tires are the most common method, but parachutes are another example
- Reason: may _____ the load on the athlete's torso and therefore may require more _____. Increases muscular force output at the hip, knee, and ankle, leading to potential increase in stride length that can result in an improvement in acceleration. Develops strength in the muscles used in sprinting, and with the proper weight used, the _____ are the same as unrestricted sprinting. May increase pelvic stabilization.
- Letzelter et al.(1995) studied the acute effect that different loads has on performance variables with female sprinters. Found that a 2.5 kg load resulted in an 8% decrease in performance over 30m, and 10 k resulted in a 22% decrease in sprint performance. _____ was affected to a far greater extent than step frequency by the increased resistance. As the load increased, decreasing step length accounted for a greater proportion of decreasing velocity. The variable affected most by increasing resistance was stance phase duration. Increased loads also caused increased upper-body lean and increased thigh angle at both the beginning and the end of the stance phase. Increased thigh angle reflects the increased need for force production during the prolonged stance phase.
- Lockie et al.(2003) studied the effect of sled towing on the _____ phase kinematics in field-sports. Athletes towed loads between 12.6 – 32.2% of their body mass over a 15 m distance. Sled towing resulted in a decrease in stride length of 10 and 24%. Stride frequency was significantly decreased compared to baseline with both both towing loads. The duration of the stance phase was also significantly increased during towing. Concluded that the heavier load led to a greater disruption of running kinematics, and recommended training with lighter loads.
- Kafer et al.(1993) studied the effects of _____ and _____ training on sprint times over 20, 40 and 60 m distances on rugby players. Resisted group recorded an average improvement of 0.08 seconds and 0.35 seconds in sprint times over 20 and 60 m distances. The combined group was significantly faster post training over both 40m and 60m. The control group showed improvements over 60m. Studied showed that the combined resisted-assisted group was signifi-

Assisted Sprints

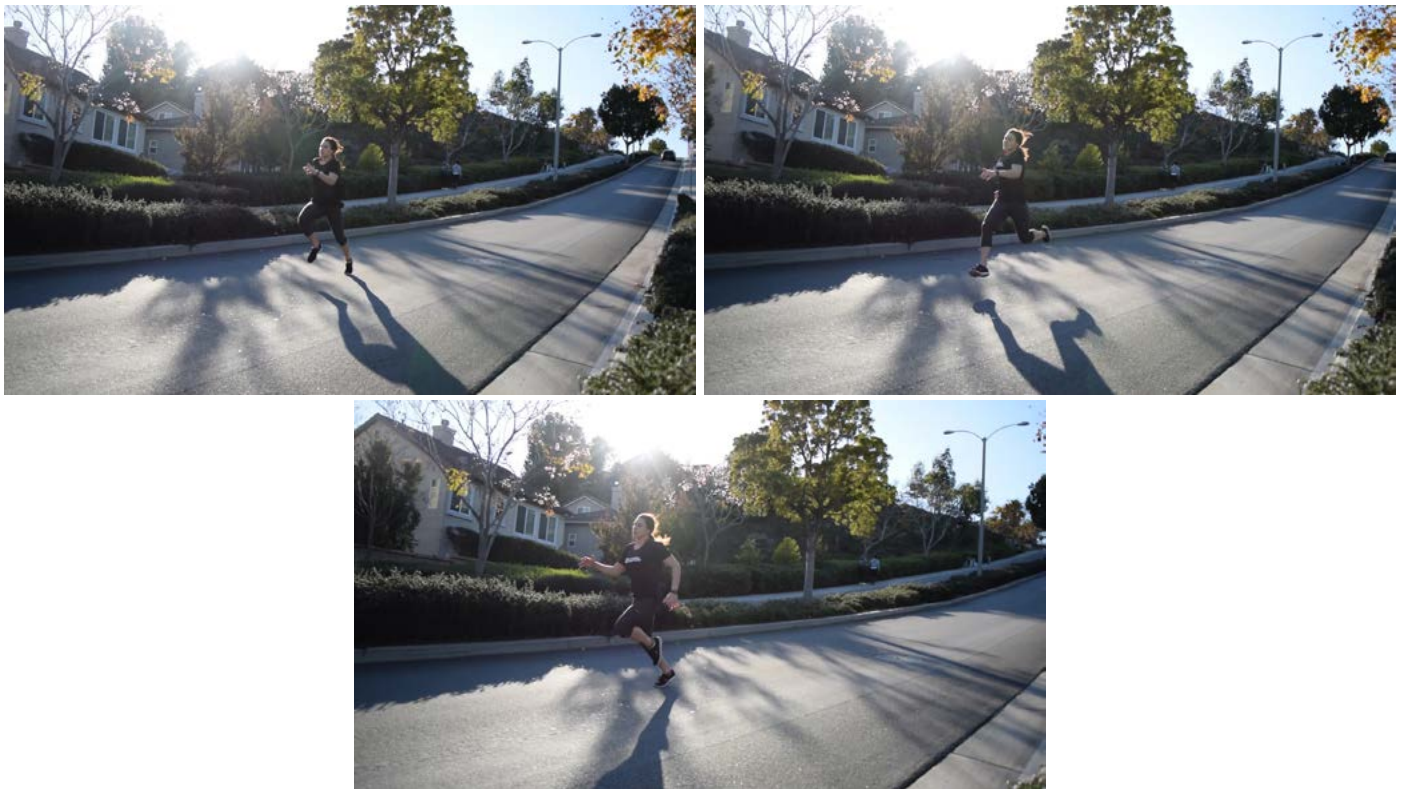
- Main purpose of assisted sprinting are to achieve higher _____ beyond the current capability of the athlete, and to train the neuromuscular system to maintain these high rates without assistance.
- By creating an _____ environment, the stretch-shortening cycle (SSC) of the neuromuscular system can improve the efficiency of the ground contact phase.
- Leads to the muscles being able to tolerate greater stretch loads and possibly storing more _____ power by increasing the stiffness of the muscle in the eccentric phase of the SSC.
- Athlete runs at greater velocities than he or she is normally capable of.
- In theory the athlete will learn how to run at greater stride _____.
- Modalities: being towed, sprinting downhill, and high speed treadmill running
- Faccioni (1995), assisted sprints can improve stride rate and elastic energy production
- Must ensure that athlete is not allowing themselves to be pulled
- Downhill sprinting will _____ horizontal velocities and stride length. Declines greater than 3% may lead to excessive stride lengths that will result in increased braking during sprinting. Should build up to assisted sprints
- Research has shown that _____ will eventually reach a plateau and stride frequency may continue to increase when approaching maximal sprinting speed; therefore attention should be focused on improving stride frequency.

Assisted Towing



- Athlete focuses not on increasing stride length but on increasing his or her _____.
- The purpose of towing is to force the athlete to take faster steps without changing technique.
- The person being towed is the athlete who will be focusing on _____ training. Allows the athlete to achieve speeds beyond his or her unassisted capability.
- Assisted towing is the best method because of the _____ characteristic. With assisted towing, the athlete still experiences an acceleration phase, with a transition to the maximal

Downhill Sprinting



- Most popular, efficient and cost-effective method
- Purpose is to improve stride frequency and the athlete uses his or her body mass, the acceleration because of gravity and the downhill slope to increase sprint speed beyond normal level ground sprinting
- Discrepancies in the recommended degree of slope
- Slope should not exceed an angle of 2-3 degrees to prevent changes in mechanics
- Another study said slope of 5.8 degrees was more beneficial than 2.1, 3.3 and 4.7
- Dintiman and Ward (1998) recommended a slope of 1-2.5% to prevent braking effect
- Bottom line... what sport does your athlete play? What phase are you training?
- Declines greater than 3% may lead to _____ stride lengths, with no increases in stride frequency, and will result in an increase in braking effect

Guidelines

- Distances should not cover more than 30-40 m
- Downhill sprints should not have an angle greater than 2-3
- Speeds should not exceed 106-110% of maximum
- Preach technique!

NOTES:

Sample Offseason Speed Training

	Day 1	Day 2	Day 3
Exercises	<p>Goal of session - Speed</p> <p>1) Dynamic Warm Up + 2-3 Technique Drills</p> <p>2) Workout Parachute Sprint 5 sets x 60 meters</p> <p>3) Cool down Myofascial Release and static stretching</p>	<p>Goal of Session - Acceleration</p> <p>1) Dynamic Warm Up + 2-3 Technique Drills</p> <p>2) Workout Uphill Sprints 3 sets x 30 meters & Assisted Towing 5 sets x 30 meters</p> <p>3) Cool down Myofascial Release and static stretching</p>	<p>Goal of Session - Conditioning</p> <p>1) Dynamic Warm Up + 2-3 Technique Drills</p> <p>2) Workout High Speed Treadmill Running 10 sets x 100 meters</p> <p>3) Cool down Myofascial Release and static stretching</p>
Rest between reps / sets (min)	3	3	1

Application: Stride Length & Stride Frequency Drills Answers

1. Rhythm
2. Optimal
3. Pre assessment
4. Over striding
5. Markers
6. Precise
7. Greater
8. Carryover
9. Maximum
10. Rest
11. Maximum
12. Acceleration
13. Consecutive
14. Speed barrier
15. Nervous system
16. Acceleration
17. Stance phase
18. Recruit
19. Trunk
20. Slow
21. Mechanics
22. Inertia
23. Contralateral
24. Thigh extensors
25. Propulsive
26. Grade
27. Decrease
28. Decreased
29. Resembling
30. Vertical
31. Maximum velocity
32. Eccentric
33. Decrease
34. Sprinting
35. Increase
36. Stabilization
37. Kinematics
38. Step length
39. Acceleration
40. Resisted
41. Assisted
42. Velocities
43. Overspeed
44. Elastic power
45. Frequencies
46. Increase

47. Stride length
48. Stride frequency
49. Overspeed
50. Sport-specific
51. Kinematics
52. Mechanical load
53. Kinetics
54. Excessive

V

**Application: Strength Training &
Plyometrics**

Application: Strength Training & Plyometrics

Strength Training

- Goal is to increase the size of the _____ and strength of athlete, which improves the ability to generate _____.
- Biomechanically, a coach must know which muscles are the most important for the particular sport being training. Sprinting is a unilateral and mainly horizontal movement. During ground contact, only one leg is loading the muscles to propel the body's mass forward, while the other leg is in the swing phase preparing for ground contact. To meet specificity of training, more unilateral and horizontal exercises are needed for sprinting.
- Squats and single leg squats will help improve short sprints and starting ability, and reverse hyper-extensions, and Romanian deadlift or single leg RDLs that strongly activate the gluteal and hamstring muscle groups are more specific to maximum-speed sprinting.
- Research suggests that the musculature around the _____ is more important in sprinting than that around the knee.
- Muscles around the hip acts as a _____. The _____ assist in pulling the leg forward- a faster flexion of the hip and leg recovery. The _____ (gluteals and hamstrings) drive the body forward and perform concentric and eccentric actions during the ground contact phase.
- Elite sprinters had superior hip extension velocities compared with subelite sprinters.
- _____ produce the greatest muscle moments during sprinting and are active during the start of the sprint and increase activity as running speed increases. Although the hamstrings play a more important role than the gluteals, they are many sprinters weakest link.
- Hamstrings have significant potential to limit sprint performance.
- _____ undergo the greatest amount of force during the eccentric contraction of the swing phase and are the most prone to injury.
- Hamstring curls focusing on a rapid eccentric component.
- No clear consensus as to which load intensity is most beneficial during resistance training. The relationship between speed and maximal leg strength tends to be nonsignificant because of the squat exercise having a different velocity/acceleration profile than sprinting.

Unilateral RDL



Notes:

Contralateral RDL



Notes:

TRX Split Squat



Notes:

TRX Single Leg Squat



Notes:

Body Weight Squat



Notes:

Reverse Hypers



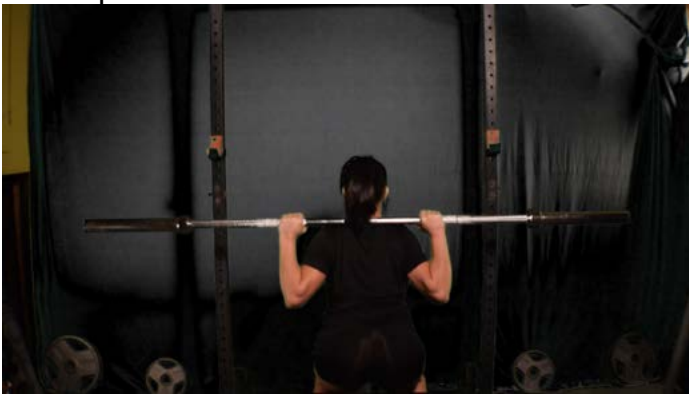
Notes:

Bench Press



Notes:

Box Squat



Notes:

Barbell Squat



Notes:

Plyometrics

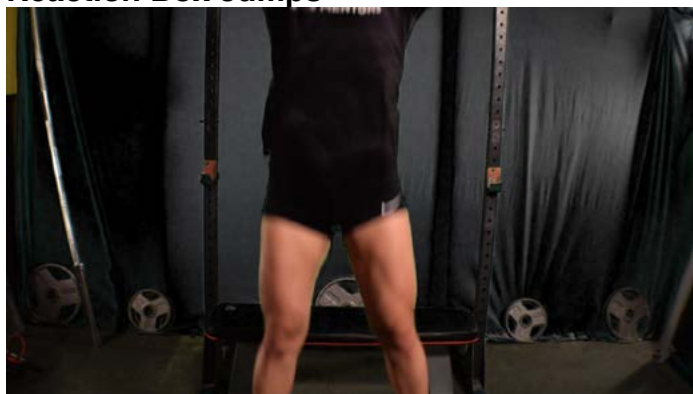
- Used to develop _____ force in a short amount of time by training the SSC. During the eccentric contraction, elastic energy is generated and stored for the concentric contraction. The elastic energy stored during the eccentric phase is then released during the concentric phase. The faster the eccentric loading, the more powerful the _____ contraction. The objective of plyometric training then is to achieve _____ on, which loads the muscle and then rapidly switch to a concentric contraction.
- Specificity of training applies to plyometrics.
- Sprinting is a horizontal movement and requires movement in the horizontal plane. The plyometric exercises that involve muscle velocities that closely resemble those of sprinting and emphasize forward motion with minimum vertical motion will have the greatest transfer to sprinting ability.
- Place a large amount of strain on the body, and a high-frequency training plan may push the body beyond its limit; thus a solid base of weight training is recommended before starting plyometrics

Split Squat Jumps



Notes:

Reaction Box Jumps



Notes:

Speed Training Programming Guidelines

- Specificity of Sport! Create a program that meets the need of your athlete.
- Distances
- Drills
- Frequency
- Etc
- Keep your athlete fresh. Sprinting is taxing and maximum sprinting can have negative effects
- Sound technique should always be stressed
- Athletes should be progressed in an appropriate manner
- Your programming should have a plan and focus per day
- Have appropriate rest periods!

VI

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