

Running injury prevention

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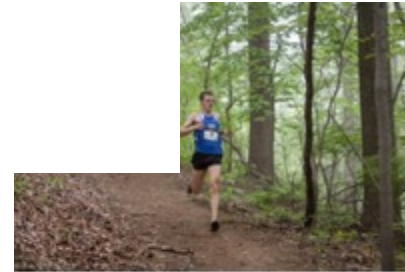
UVA Runner's Clinic
Team Physician UVA Athletics



Objectives

- Review most common mistakes seen in my office
- Discuss cause of most running injuries
- Review ways of preventing most common running injuries
- Discuss some unique ultra running medicine topics
- No disclosures

How'd I get here?



"I should stop
running until that
pain goes away,"
said no runner ever.



som^{ee}cards
user card

Most common mistakes

- Transitions, transitions, transitions
 - Shoes
 - General rule replace shoes every 400 miles
 - Don't fix it if it ain't broke
 - Mileage
 - 10% per week with LR not greater than 20% of total weekly mileage
 - Ultra training considerations-time on your feet
 - Surface
 - Train what you are going to race on
 - Intensity
 - Life changes
- Ignoring your body
- Too much work with too little recovery



Running injuries



Epidemiology of Running Injuries

- 30 million active runners
- 70% all runners sustain significant injury
 - 40% knee
 - 15% each: shin, achilles, hip/groin
 - 10% foot and ankle
 - 5% spine



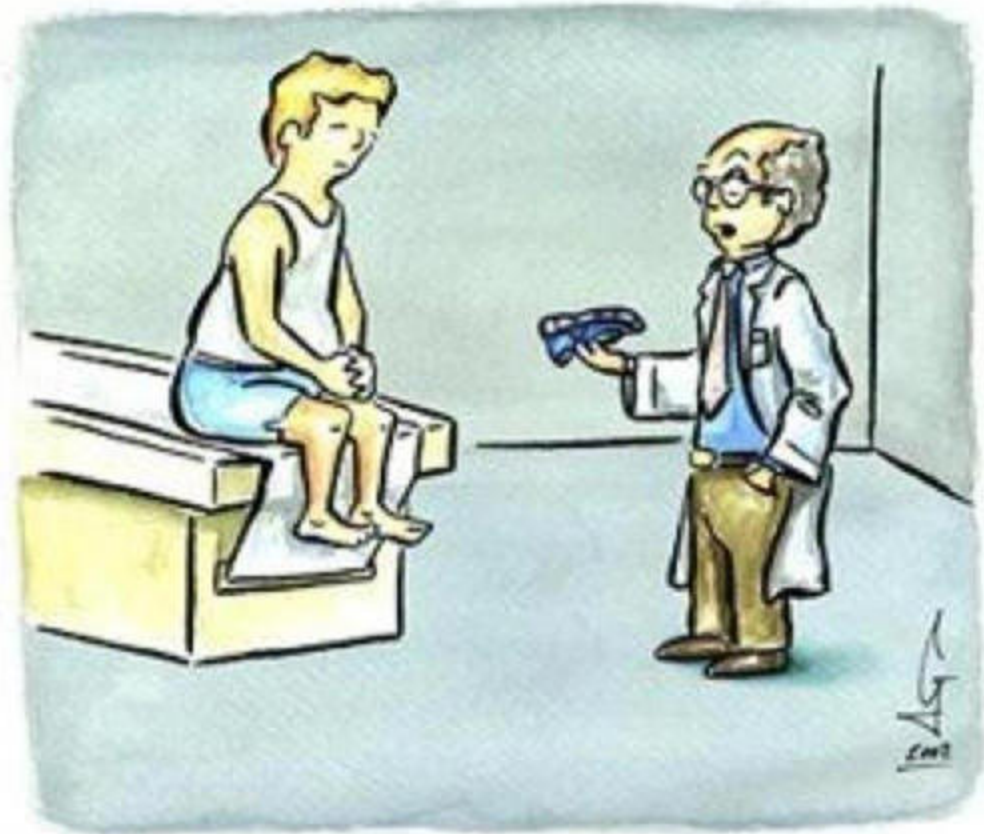
Intrinsic Abnormalities

- Malalignment
- Muscle imbalance
- Inflexibility
- Muscle weakness
- Instability



Extrinsic Abnormalities

- Training errors
- Equipment
- Environment
- Technique
- Sport-imposed deficiencies



"The wear pattern on your running shoes suggests that you watch too much TV."

Examination of the Injured Runner

History

Biomechanical assessment

Site-specific exam

Dynamic exam

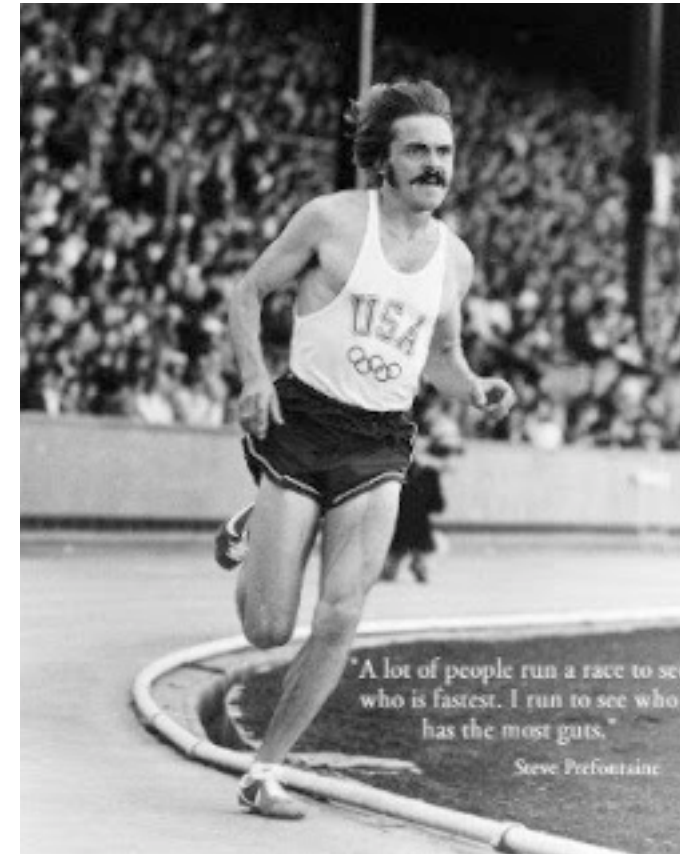
Shoe exam

Ancillary testing

radiologic

electrodiagnostic

compartment testing



History

- Prior injury history
- Team/Club
- Identify transitions
- MPW (20, 40)
- Long run ($\leq 1/3$ weekly total)
- Intensity
- Surface
- Shoes/orthotics (350-400 miles)
- Cross Training
- Goals
- Life Stressors/fatigue
- Females: eat d/o, menstrual irreg, osteopenia



Shoes

- Lots of options (a good thing)
- Can affect impact forces, loading rates, torque forces
- Is it the shoes, form or both?
- Rarely does “one size fit all”
- If it ain't broke, don't fix it?
- All transitions gradual
- With barefoot, minimalist ensure stability and form cues



Functional Screening

Single Leg Stance & Squat



Functional Screening



FHB Isolation

Functional Screening

Swing Test



Running Gait & Form





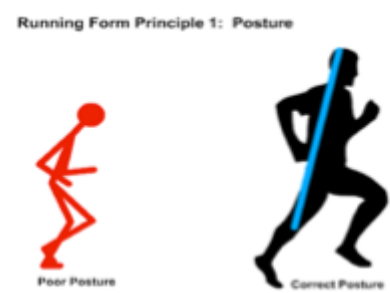
Barefoot Running Gait

- Mark Cucuzzella Barefoot Running Gait
(<https://www.youtube.com/watch?v=kpnhKcvbsMM>)

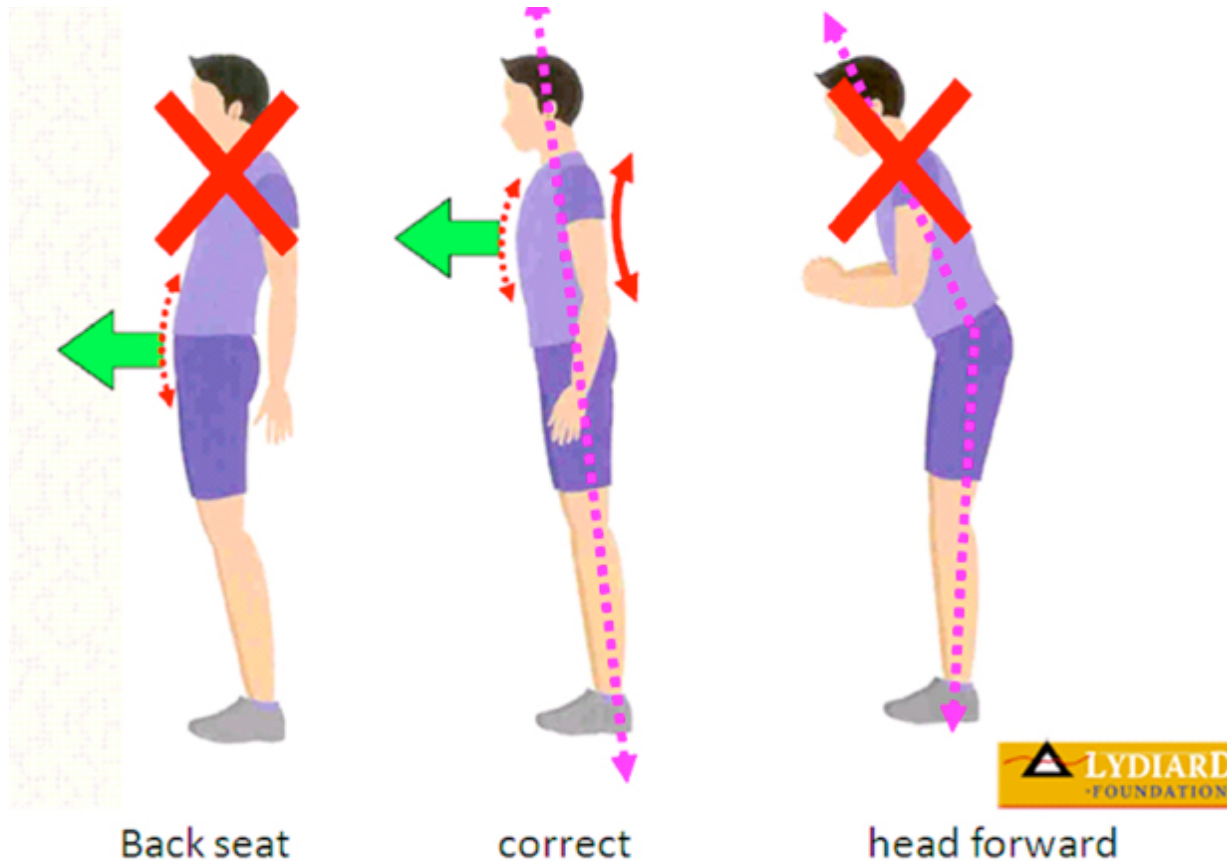
Running Gait & Form

POSTURE

- Run tall – imagine your column being stacked under your head
- Look straight ahead to the horizon
- To move forward lean in like giving a kiss



Correct Body Position



Running Gait & Form

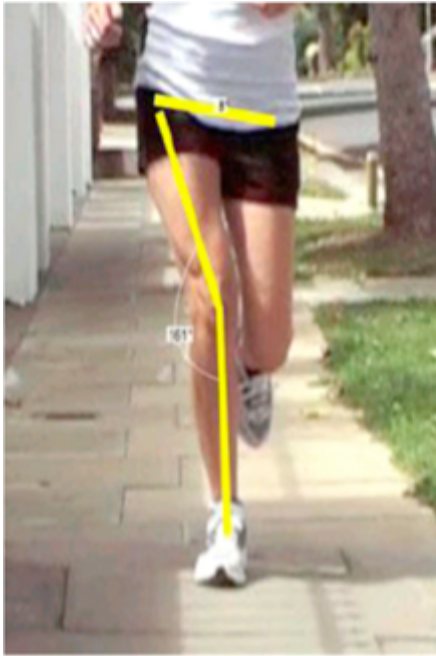
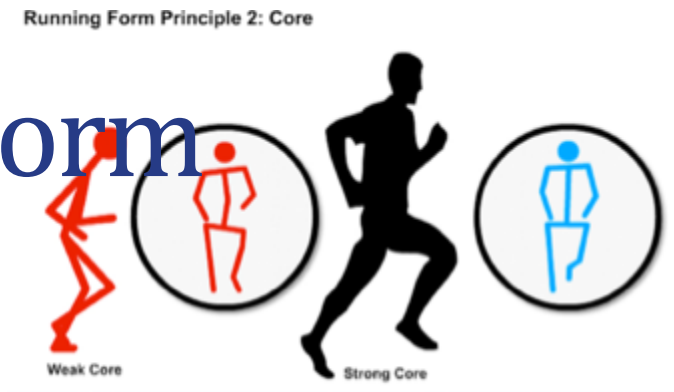
Core

= abdominals, hips, and glutes
strong and stable while in motion
proper timing of nerves and muscles- neuromuscular
allows optimal energy transfer from the ground

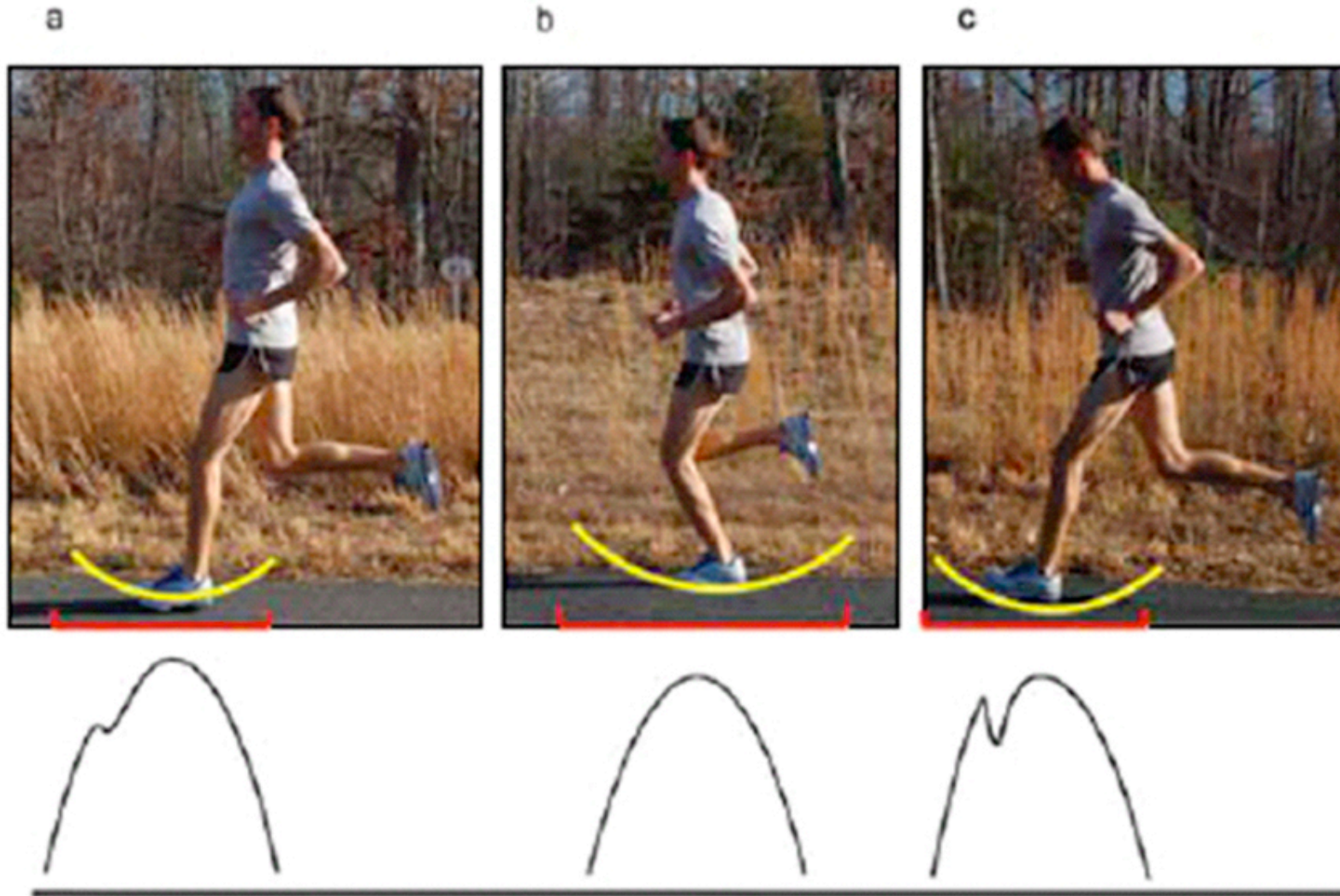
Running Form Principle 2: Core



Running Gait & Form



Running Gait & Form



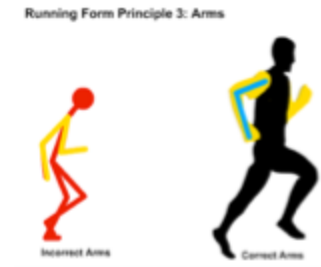
The effect of a) backseat running, b) good alignment, and c) toilet bowl syndrome on loading rates.

Running Gait & Form

- **Arms**: set your rhythm
 - elbows at 90 degrees (knuckles facing sternum)
 - relaxed rearward drive of elbow
 - arms reflexively come forward

Do Not:

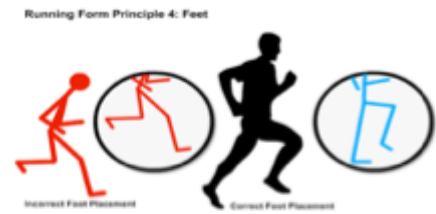
- cross center
- pump arms
- arm out in front and overstride



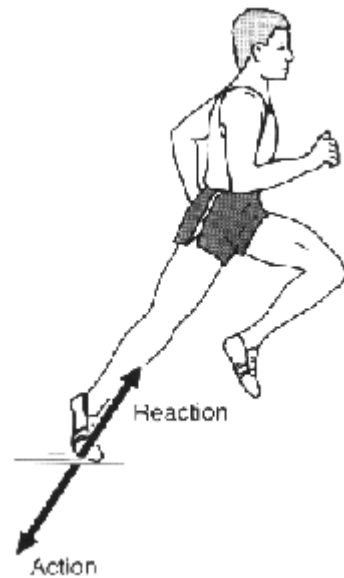
Running Gait & Form

- **FEET**

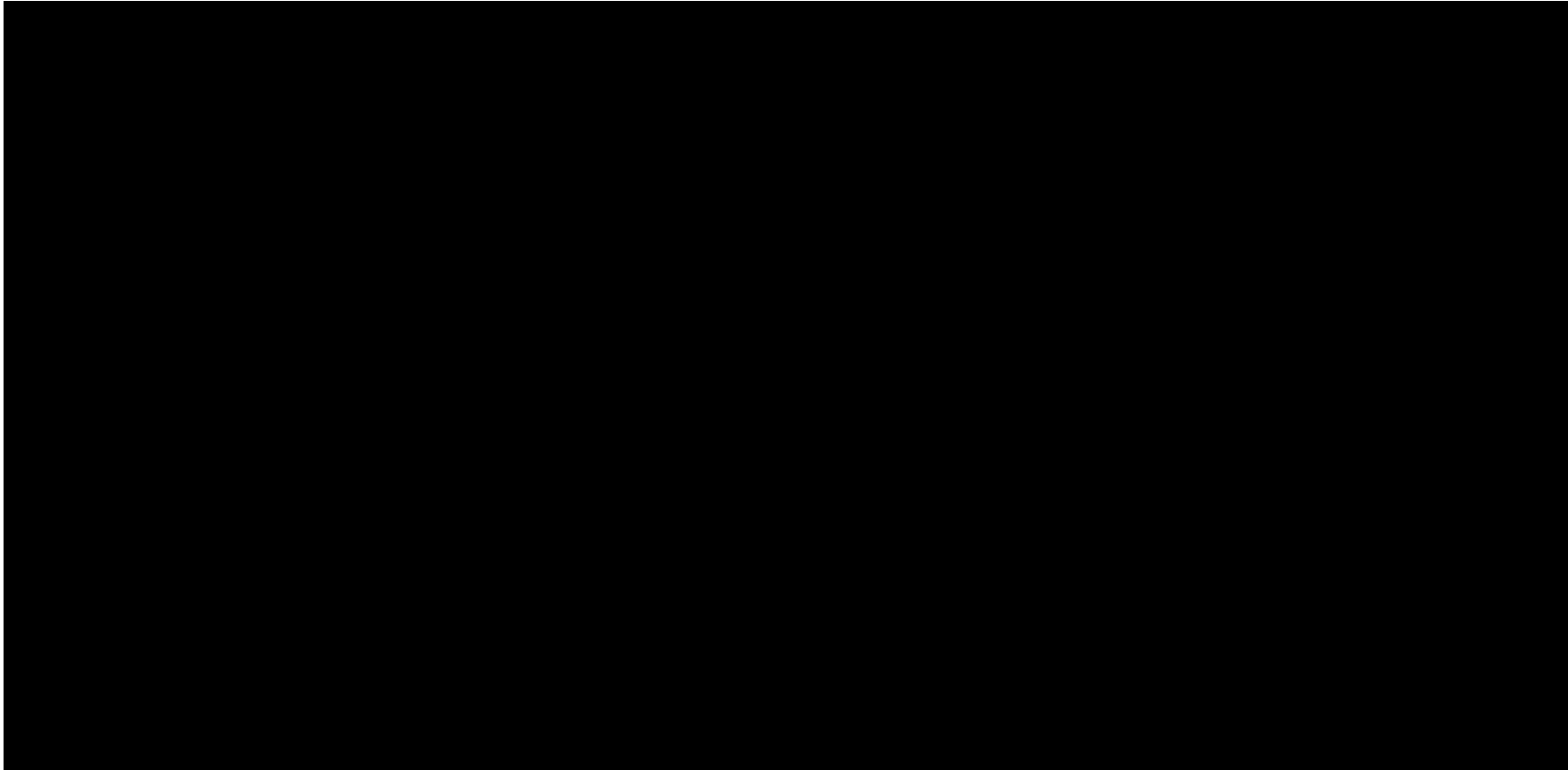
- Feet land close to center of gravity
- FULL foot contacts ground
- Balance and Rhythm
- Legs store and release energy



Ground reaction forces



Boston 3 hour group



https://www.youtube.com/watch?v=67_A1A7MoAc

Boston Elite form



- <https://vimeo.com/11574380>

Running Gait & Form



Running Gait & Form

- **Cadence**

- harness the energy from your springs
- Engage the glutes and pop off the ground
- extend hips to propel forward
- cadence 170-180 steps per minute



What can we do?

- Core stability/strength
- Glute activation

Glute Bridge With Marching



Plank With Diagonal Arm Reach



Side Plank With Marching

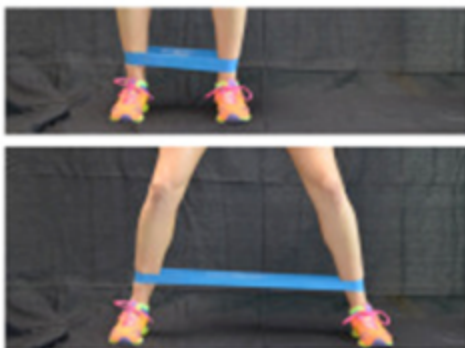


Glute Bridge With Adduction and Knee Extension



Y's on the Floor







CHAIR OF DEATH

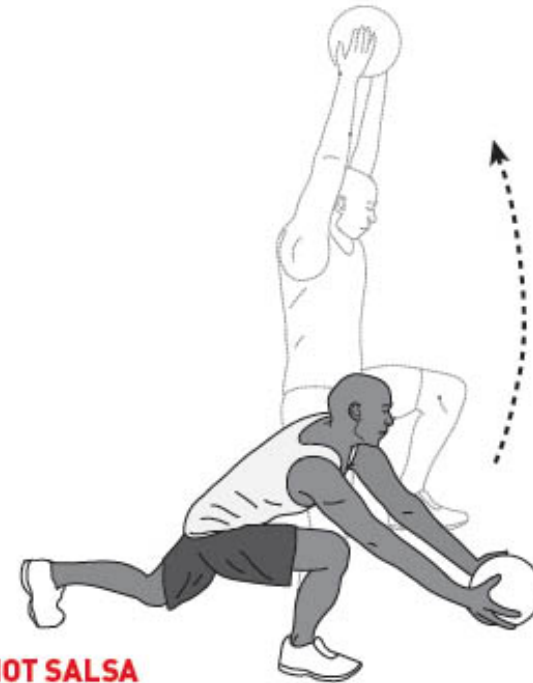


Running specific strength

- Hot Salsa
- Mountain climbers

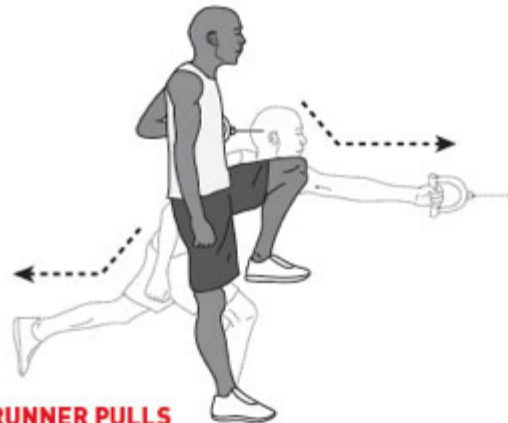


MOUNTAIN CLIMBERS



HOT SALSA

- Runner pulls



RUNNER PULLS



RUNNER TOUCH

Running specific strength

- Ninja box jumps
- Kettle bells
- Four square drill
- Run with a tether



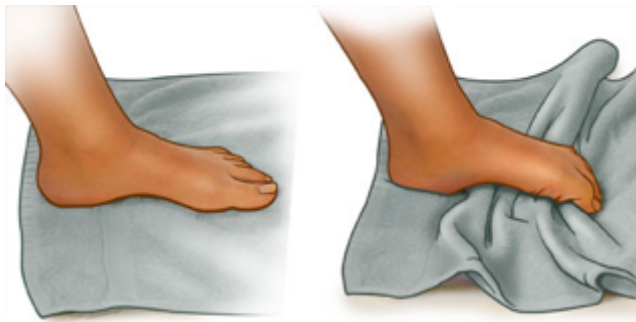
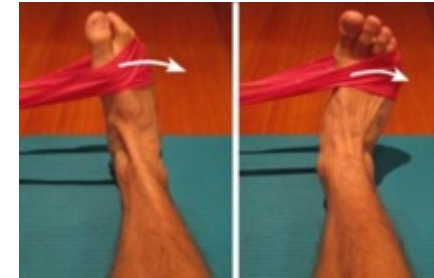
What can we do?

- Toe yoga



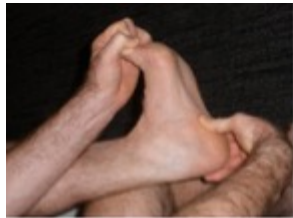
What can we do?

- Foot and ankle strengthening
 - Foot and Ankle Strengthening (include eccentric)
 - Toe crunch
 - Single/double heel raise
 - Inversion/eversion



What can we do?

- Foot and ankle flexibility
 - Heel cord flexibility
 - Plantar fascia



What can we do?

- Foam rolling
- Hip flexibility



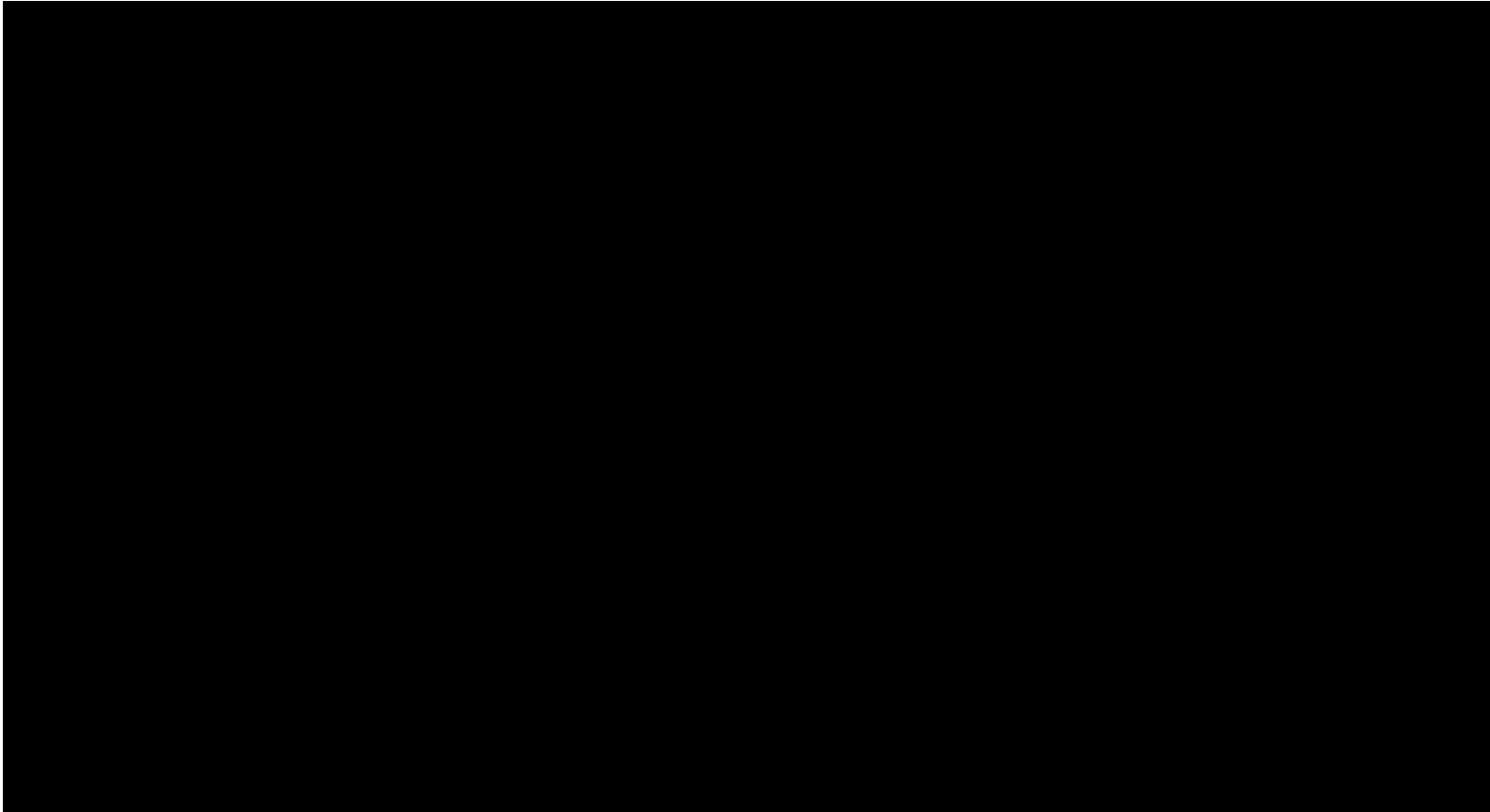
How should I warm up?

- 10-15 min walk/jog
- Dynamic warm up
 - Drills & exercises



Drills

- <https://www.youtube.com/watch?v=CrDLDUUnJvN4>



Drills

- Drills (A,B,C,D skips, karaoke, jump rope)



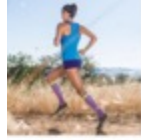
Cool-down

- Recover, Recovery, Recovery
 - Don't stop! Keep moving!
 - Cool down jog or walk
 - Post race Massage
 - Foam roller
 - Eat and Drink!
 - 20-40 minutes after you finish activity is the ideal window when your body is going to absorb the most nutrients and allow you to recover the best.
 - 3:1 ratio in terms of carb to protein
 - chocolate milk
 - Rehydrate
 - Especially hot races, It's not uncommon to lose a couple to a few pounds after a hot race.
 - Replace weight loss with water and electrolyte drinks



Cool-down

- Compression socks
- Ice Baths
- Sleep (7-8 hours minimum)
- Mental recovery



Ok I feel something coming on...

Relative Activity Modification Guidelines

1. Run with no more than mild pain (0-3/10)
2. Pain that goes away with running a good sign.
3. No limping

When to see the doc?

- Pain at rest/at night
- Pain with non-running daily activities (walking)
- Persistent (>1 week) pain
- Active sciatica (numbness, tingling, weakness)
- Active joint swelling



Cross Train

- Bike
- Elliptical
- Hike
- Swim
- Pool Run



Am I going to run myself into a knee replacement?

- Scientific literature is mixed
 - Human and animal studies
 - Running can affect composition and mechanical properties of cartilage.
 - Moderate-volume running seems beneficial.
 - High-volume running can lead to decreased proteoglycan content, decreased cartilage stiffness, and sub-chondral bone changes, but unclear if this is equivalent to symptomatic OA.
 - Strong evidence that prior joint injury, greater body mass index, heavy manual labor are associated with OA
 - Existing literature does not support relationship between low and moderate volume running and OA
 - Literature inconclusive regarding relationship between high volume running and OA
 - Running pace may be a significant variable





Unique ultramarathon concerns

- Weather
 - Heat
 - Cold
 - Lightning



Heat Illness-Definition

- Continuum of disease that progresses along a spectrum from mild (heat cramps) through moderate (heat exhaustion) to severe (heat stroke)



Types of Heat Illness

- Sunburn
- Heat cramps
- Heat syncope
- Heat exhaustion
- HEATSTROKE
 - **mild can progress to severe quickly!**

Heat Illness – risk factors

- Lack of acclimatization
 - Acclimatization takes 10-14 days
- Responses include:
 - Lower core temperature at onset of sweating
 - Increased heat loss via radiation and convection (skin blood flow)
 - Increased plasma volume
 - Autonomic NS redirects blood flow to skin and active muscles
 - Decreased heart rate

Heat Illness – risk factors continued

- Elderly (decreased thermoregulation, meds)
- Children (high ratio BSA to weight, lack access to fluids)
- Recent bout heat illness
- Fever
- Overweight
- Sustained exercise
- Hot humid weather
- Medications (caffeine, ADHD medications, antidepressants, antihistamines, alcohol, etc)

Heat Stress - Prevention

- Education
- Acclimatization (10-14 days)
- Avoid extremes of heat, humidity
- Light, loose-fitting clothing
- Fluid replacement

Methods of Cooling – Have ready!

- Shade
- Air Conditioning
- Fans, Mist
- Showers
- Ice Water Towels
- Ice Bags
- Ice Water Immersion

Heat Illness - Mild

- Type:
 - Heat cramps
 - Heat syncope
- Symptoms
 - Muscle tightness or spasm
 - Postural hypotension
 - Increased pulse
- Treatment
 - Rest, cooling
 - Oral glucose-electrolyte
 - Remove from sun
 - Lie down
 - Elevate legs and pelvis

Heat Illness - Moderate

- Type
 - Heat exhaustion
- Symptoms
 - Headache, exhaustion, weakness, nausea
- Signs
 - Increased sweating
 - Decreased blood pressure
 - Increased heart rate
- Treatment
 - Rest, cooling
 - May need intravenous fluids (other treatment per mild)

Heat Illness - Severe

- Type
 - Heatstroke
- Symptoms
 - Impaired consciousness, confusion, ataxia
- Signs
 - Decreased blood pressure
 - $T > 104^{\circ}\text{F}$ (rectal)
 - Increased heart rate
 - Hot, dry skin, or cold, clammy skin
- Treatment
 - Medical emergency: rapid cooling (to 102°), intravenous fluids, assisted respiration, transport
 - Monitor for end organ damage, renal function, rebound.

Hyponatremia

Na levels < 135

- Headache, fatigue, nausea
- EAC, vomiting, MS changes
- BP, pulse often normal
- Prevention/education is key!
- Most common novice marathon runners
- Mild, > 125 Hypertonic oral solution until urinate vs HTS (3%)
- Severe hyponatremia can rapidly progress to seizure, respiratory distress, coma due to worsening pulmonary and cerebral edema.

HTS, transport

Fluid Replacement

- < 1 hour: Water
- > 1 hour: Sports drink
 - 4-8% glucose, sucrose, complex polymers (Calculate as g/ml *i.e.* Gatorade: $14\text{g}/240\text{ml} \times 100 = 5.83$ or 6%)
 - *NOTE: fructose can delay emptying)*
- 15-21° C

Fluids Before Exercise

- Pre-hydration unnecessary if euvoletic
- 4h prior: 5-7 ml/kg (1.5 cups)
- 2h prior: 3-5 ml/kg (1 cup)
- 10-20 min prior: 1 cup
- Hyperhydration discouraged

Fluids During Exercise

- Customize to prevent > **2% BW**
- To Thirst (?)
- Individualize to sweat rate
- 0.4-0.8 L/hr
- 1 cup/20-40 min



Fluid Replacement after Exercise

- Correct weight loss
- 1.5 L/Kg



Unique ultramarathon concerns

- Course hazards
 - Altitude
 - River crossing
 - Wildlife
 - Isolation





ULTRAMARATHON RUNNING

**Because 26.2 is for sissies. In real sports, you go until your organs
start shutting down.**

FreePosterMaker.com

Unique ultramarathon concerns

Rhabdomyolysis

Unaccustomed and especially eccentric (muscle lengthening while contracting) exercise can damage muscle cells, causing them to disrupt and release potentially toxic substances into the bloodstream

Why is it dangerous?

If levels get high enough, can overload kidney's ability to filter and cause acute kidney failure

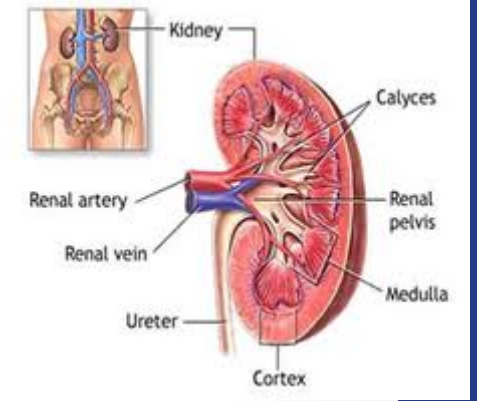
Warning Signs: Dark (Coca-Cola) colored urine, decreased urine output, back or flank pain, severe muscle aches


Risk factors: Excessive heat, severe dehydration, NSAID and/ or analgesic usage, hyponatremia, under-training and prior viral or bacterial infection

-younger and faster male runner pushing through pain to finish the race

Prevention:

- Avoid taking NSAIDs (Advil, Motrin, Aleve, Celebrex, et al.) and/or analgesics during an ultramarathon race
- Do NOT race if you had a recent viral or bacterial infection
- Do NOT over- or under-hydrate
- Train properly for the event; if you get injured, race only when you have regained proper fitness
- Listen to your body; if you have any of the above-mentioned warning signs, seek medical attention immediately!



A person wearing a red backpack and a grey jacket is running away from the camera through a dense forest of tall, thin trees. The ground is covered in dry leaves and pine needles. The scene is dimly lit, suggesting an overcast day or a deep forest.

ONLY THOSE WHO WILL
RISK GOING TOO FAR
CAN POSSIBLY FIND OUT
HOW FAR ONE CAN GO.

-T.S. ELIOT

The Runner's Clinic at UVA

Our physicians are committed to getting ALL runners “back on track”. We have experience treating all running injuries as well as providing recommendations for medical conditions that can impair running performance. Each runner receives “hands-on” expertise and an individualized treatment plan, no matter his or her age or level of proficiency.

434-243-5600

Community Partners: Our team provides sports medicine coverage to over 20 running events annually, including local road races and collegiate and high school cross country and track meets. We also provide educational seminars focusing on injury prevention and treatment and performance.

Conditions Treated:	Stress Fractures	Chronic Fatigue Syndrome
	Runner's Knee	Relative Energy Deficiency Syndrome
	Low back pain in runners	The Female Athlete Triad
	Hip and Groin pain	Exercise Induced Bronchospasm
	Patellar tendinitis	Iron Deficiency
	Achilles tendinitis	Exertional Compartment Syndrome
	Plantar Fasciitis	...and many others!
	Metatarsalgia	
	Neuromas	

We perform:	Running Gait analysis	Musculoskeletal Ultrasound
	Running shoe evaluation	Electro-diagnostic testing
	Biomechanical evaluation	Return to run planning
	Exertional Compartment Testing	Customized rehabilitation programs

Thank you!



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