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Unique Problems in the Active and Athletic Female Patient

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Overview

- Briefly discuss a historical perspective of women in sports.
- Discuss differences between men and women that impact PA and sports.
- Review a range of common orthopedic and medical problems seen in female athletes.

Women in Sports

- Title IX enacted in 1972, led to explosion in women's sports participation.
  - HS sports participation increased from 300K to over 2.7 million today.
  - 44% of all collegiate athletes.
  - 48% of all US Olympic athletes.
- Women's professional sports have flourished, led by tennis, golf and volleyball. More recently basketball and soccer.

Pioneering Female Athletes

- 1900: Charlotte Cooper (Olympic tennis champ).
- 1920s: Gertrude Ederle (swam English Channel 2 hr faster than anyone).
- 1932: Babe Didrikson (3 Olympic medals).
- 1960: Wilma Rudolph (1st woman to win 3 Olympic gold medals).

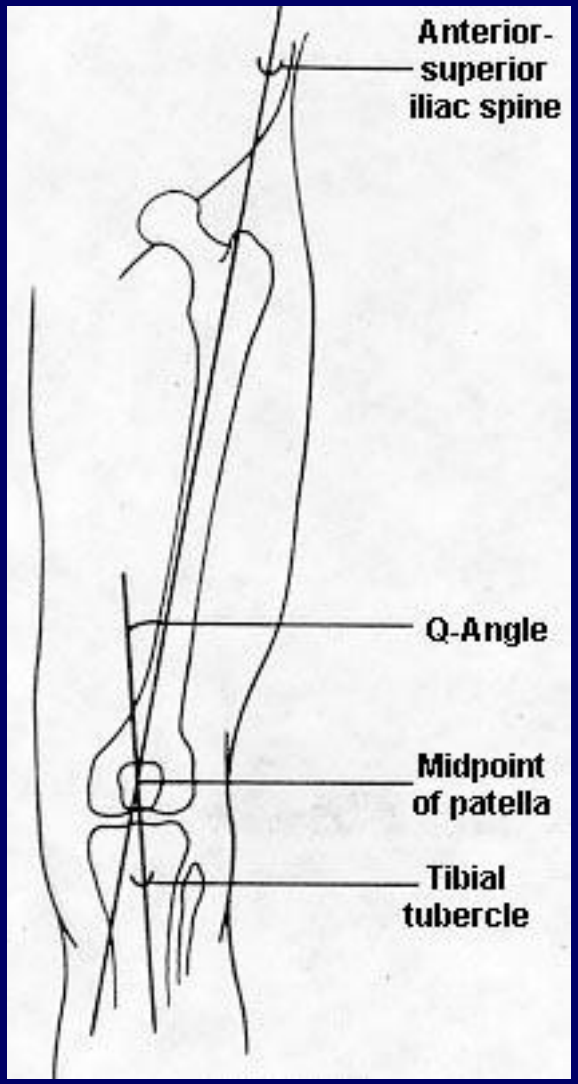
Pioneering Female Athletes

- 1972: Olga Korbut (4 Olympic medals).
- 1978: Ann Meyers (4 time basketball All American).
- 1984: Joan Benoit (Olympic marathon gold).
- 1996: USA Soccer team (Olympic gold medal).

Differences Between a Man and Woman

Anatomy of the Female Athlete

- Female athletes generally shorter and weigh less – generate less power.
- Lower center of gravity.
- Less muscle mass per total body weight and greater % body fat.
- Wider pelvis leads to greater varus at the hips and valgus at the knees.



Increased Q-Angle

Physiology of the Female Athlete

- Pre-pubertal girl's & boy's physically similar – can fairly compete until age 10-11.
- After puberty, girls develop:
  - Increased body fat (~25% vs. ~14% in boys).
  - Smaller heart size & LV mass = ⇩ cardiac SV.
  - Lower Hgb levels.
  - $V0_{2max}$ ~28% less than men.
- Girls have fewer sweat glands, but less body mass; More surface area and less muscle bulk to generate heat (no increase heat risk).

Bodily Differences that Convey Performance Advantages

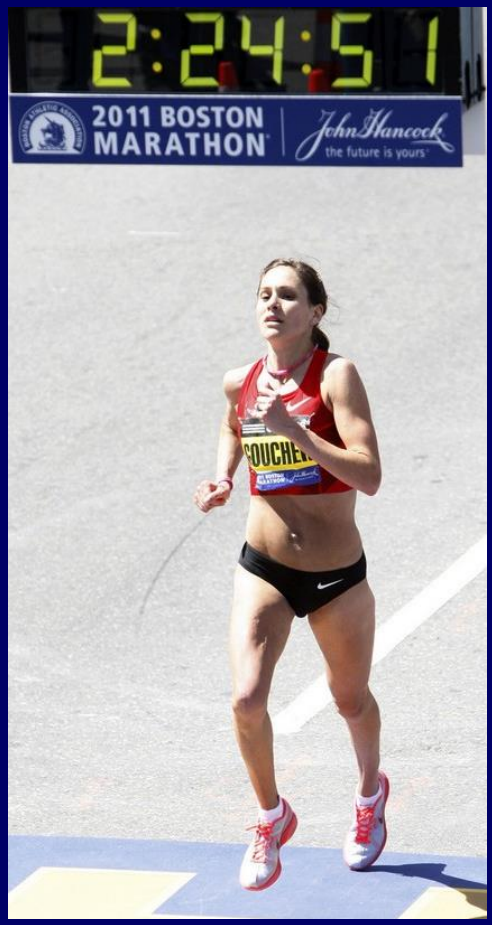
- Higher Body Fat – helps buoyancy & cold insulation; Advantage in long distance swimming.
- Lower Center of Gravity – helps balance; Advantage in wrestling and fencing.
- Lower weight – Advantage riding horses, cars, planes and boats.
- Estrogen – may increase water retention and lessen muscle damage & soreness; Advantage in ultra-endurance runs and swims.

Physiological Changes of Pregnancy

- Cardiovascular - increased RBC mass & plasma volume lead to higher cardiac output.
- Musculoskeletal - growing breasts, uterus and fetus alter center of gravity causing problems with balance.
  - Also increased joint laxity (thought to be risk for strains or sprains).
- Pulmonary - oxygen consumption increases, tidal volume increases.
- Metabolic rate is increased; VO2 max is increased until weight gain cancels.

Effects of Pregnancy on Exercise Performance

- Endurance performance may improve during the 1st trimester due to increased blood volume and RBC mass; Pregnancy induced "Blood Doping" or "Abortion Doping".
  - Progressive performance decline during pregnancy seen with weight bearing exercise.
  - No performance decline seen with non-weight bearing exercise.
- Performance may be improved post partum.



Kara Goucher

Pre-Participation Evaluation (PPE)

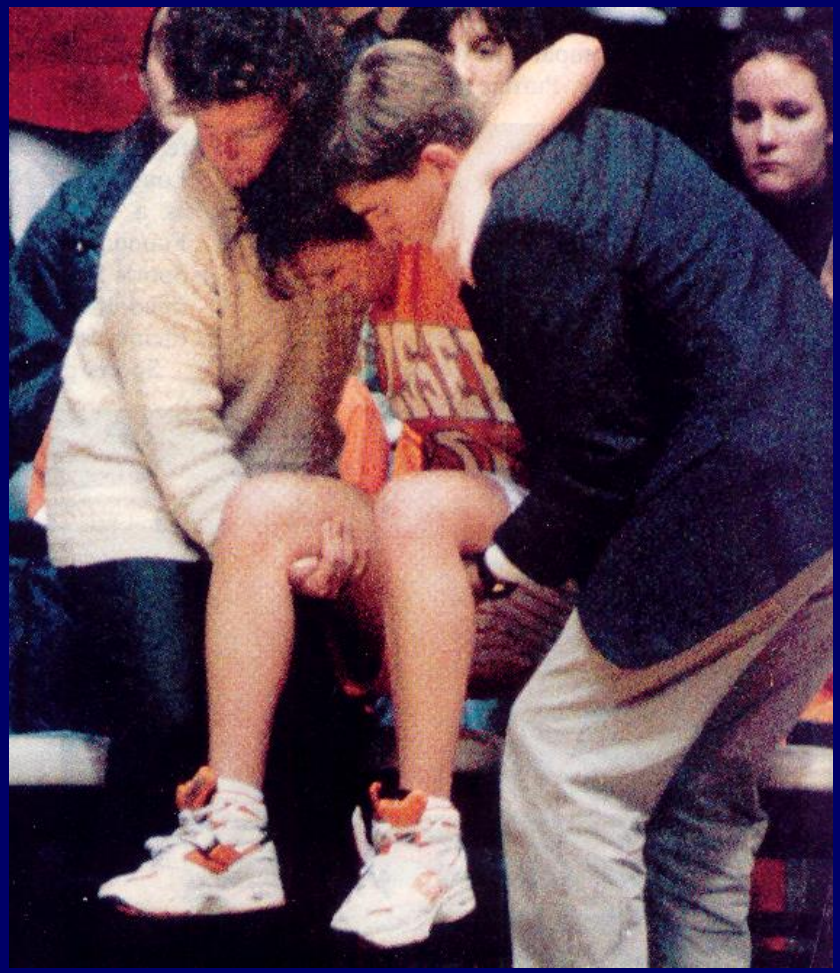
- Components of the PPE are the same for men and women.
- Conditions more common in women - anemia, concussion, eating disorders, PFD, stress fractures, foot & shoulder problems and scoliosis.
- Age menarche in athletes ~13.5-15.5 yrs (vs. 12.5 yrs in non-athletes). 1^{o} amenorrhea if no period by 16.

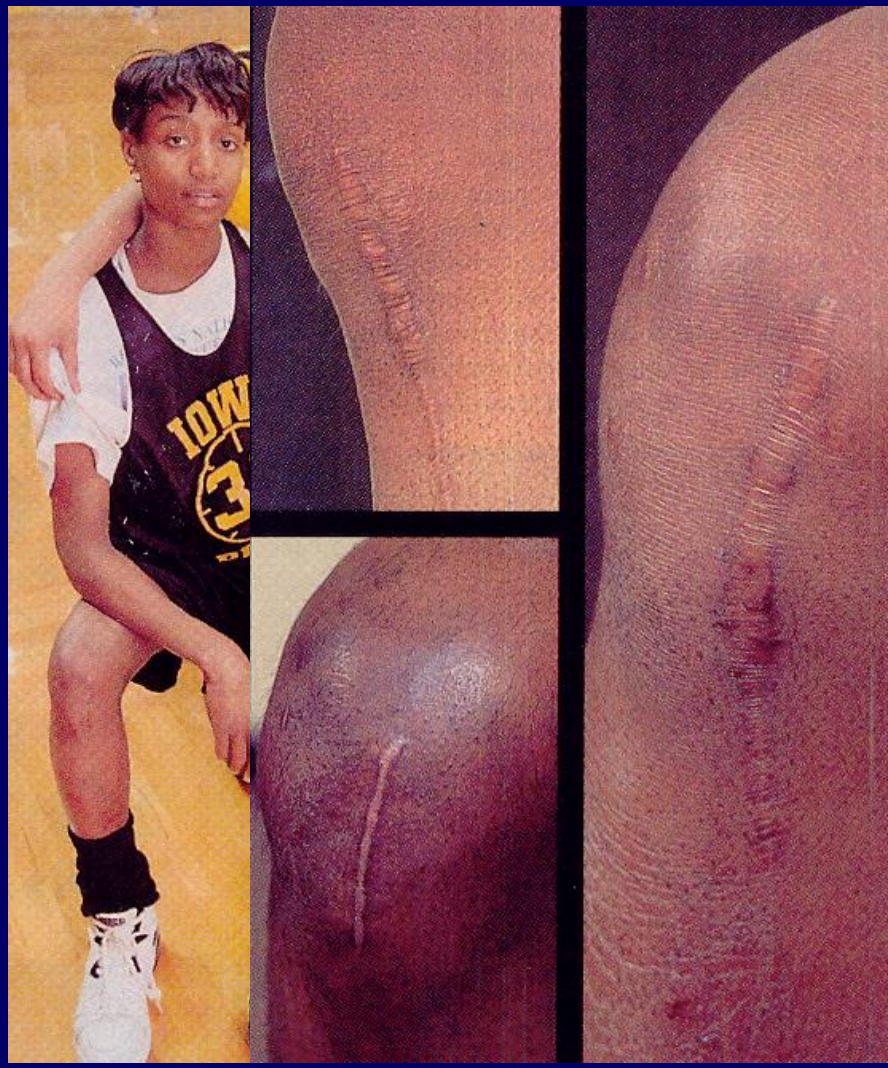
Comparing Men's & Women's Sports Injuries

- Reviewed all injuries over a 15 year period at NCAA division III college.
- 3,767 participants with 1,874 sports-related injuries reported among men and women's teams.
- Compared pattern of injury between men and women in 7 like collegiate sports.
- Results showed little difference in the pattern of injury between men and women competing in like sports.

Sallis; Int J Sports Med; 2001 Aug;22(6).

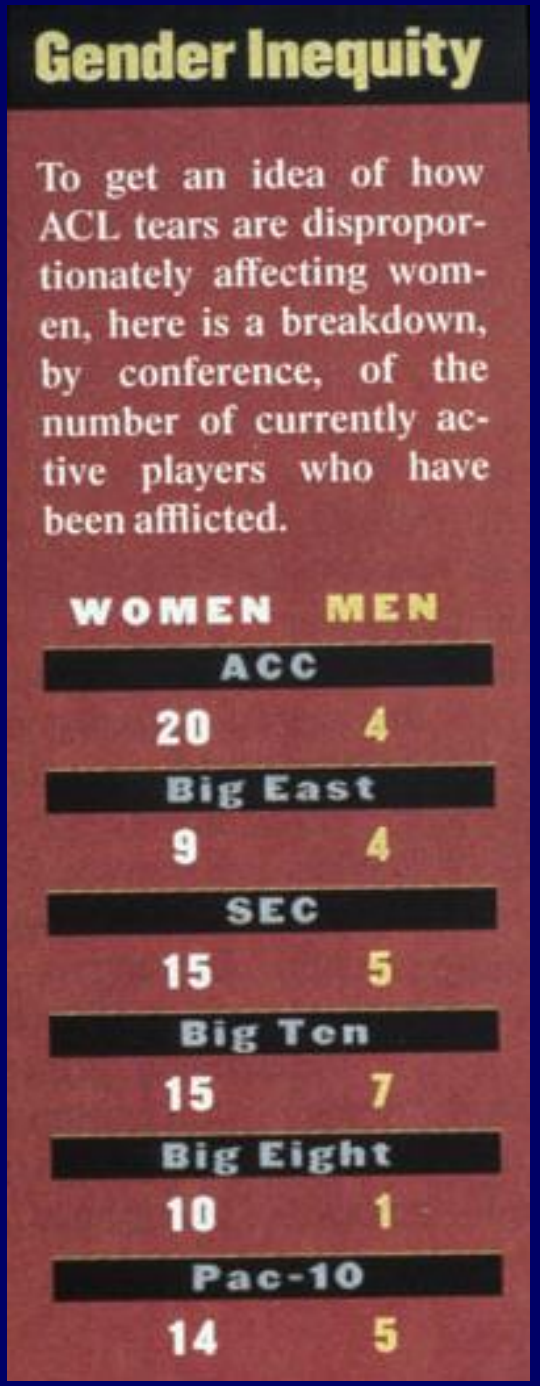
ACL Tears
"A Crisis in *Women's Sports*"





ACL Tear

- Increased incidence of non-contact ACL tears in women.
- 4x greater in basketball; 2.5x in soccer. Why?
  - Smaller ligaments and notch.
  - Biomechanics and coordination.
  - Hormonally induced laxity.



ACL Tear - Diagnosis

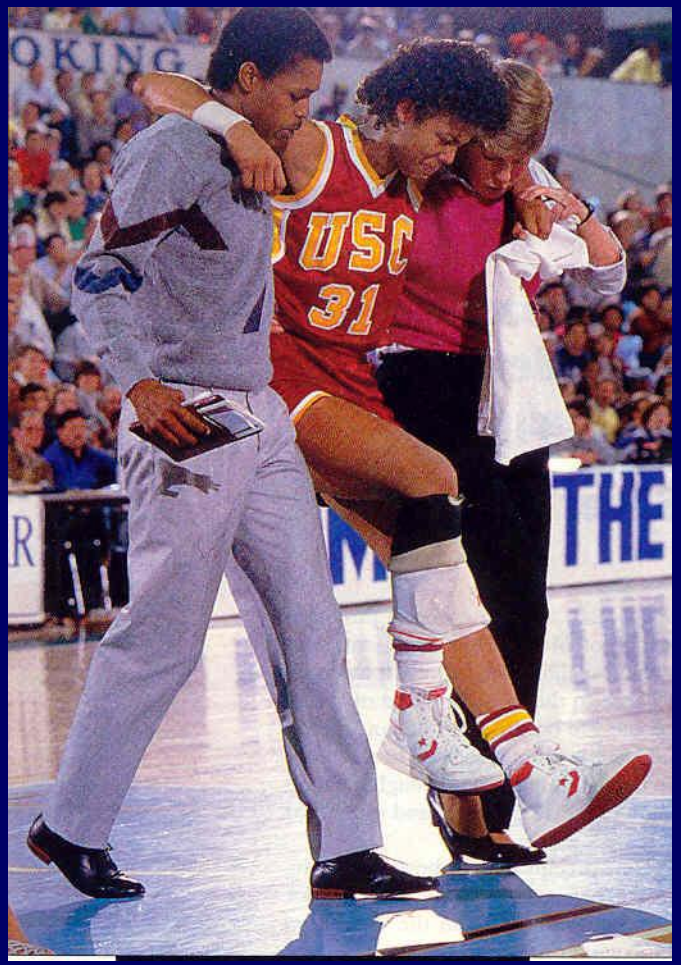
- Hx: twisting injury, feel "pop", large effusion.
  - Usually non-contact.
  - "Fist sign."
  - Meniscus tear often accompanies.
- Exam:
  - Lachman test.
  - Anterior Drawer test.

ACL Tear – Initial Treatment

- RICE; pain meds as needed.
- Knee immobilizer or hinged knee brace with crutches for comfort. Wt. bear as tolerated.
- Straight leg exercises from day 1.
- Hamstring exercises as soon as tolerated.

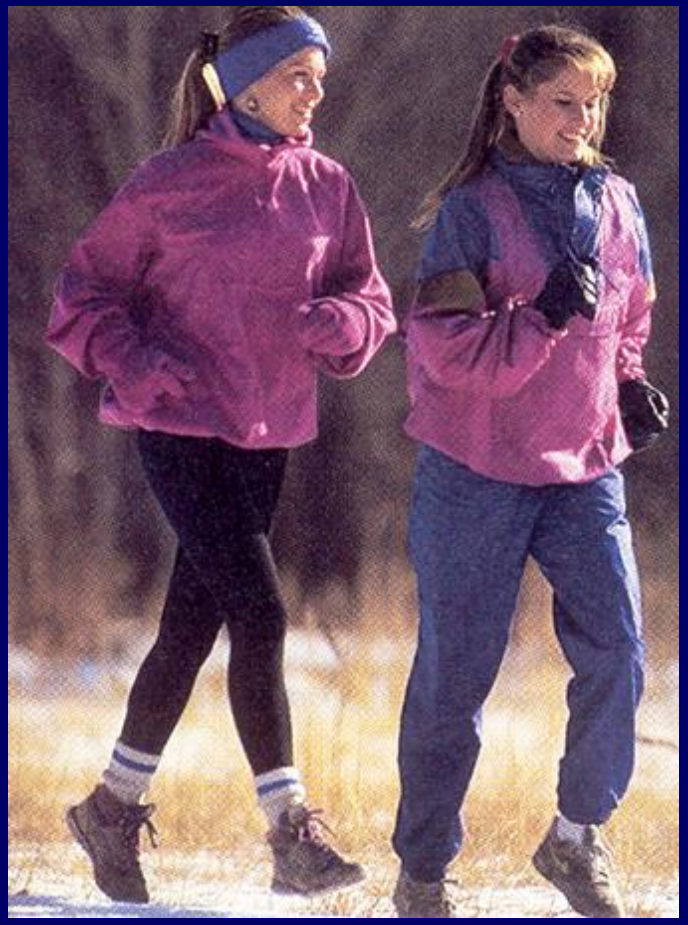
ACL Tear
Candidates for Surgical Treatment

- Those with very loose knee (giving way, pivot shift etc).
- Young patients involved in high level competitive sports.
  - Cutting or twisting sports (basketball, soccer, skiing etc).
- Physically demanding job.
- Unable or unwilling to alter physical activity.



ACL Tear
Candidates for Conservative Treatment

- Older or more sedentary patients.
- Patients who enjoy sports without much cutting or twisting (running, biking, swimming etc).
- Patients willing to alter their physical activity.
- Patients with stable knee (no giveway).



ACL Tear - Prevention

- Variety of ACL prevention programs show promise.
- Santa Monica ACL Prevention program demonstrated an 88% reduction in ACL tears using three types of exercises.
  - Flexibility
  - Strength
  - Plyometrics

Shoulder Instability

- Women may be at increased risk due to generalized laxity.
- Instability continuum:
  - Wide variation in normal flexibility.
  - Laxity→subluxation→ dislocation.
  - Frequently increased in throwers or swimmers.

Shoulder Instability - Diagnosis

- Causes: congenital, repeated microtrauma, acute trauma (dislocation).
- Symptoms: often subtle – may feel like shoulder "slips out" or present with symptoms of RC injury, impingement or labrum injury.
- Exam: apprehension tests, sulcus sign.

Treatment of Shoulder Instability

- Treat associated RC injury, impingement or labrum injury.
- Rehab exercises are key -- both flexibility and strengthening.
- Surgical treatment is last resort (poor results in throwers).

Scoliosis

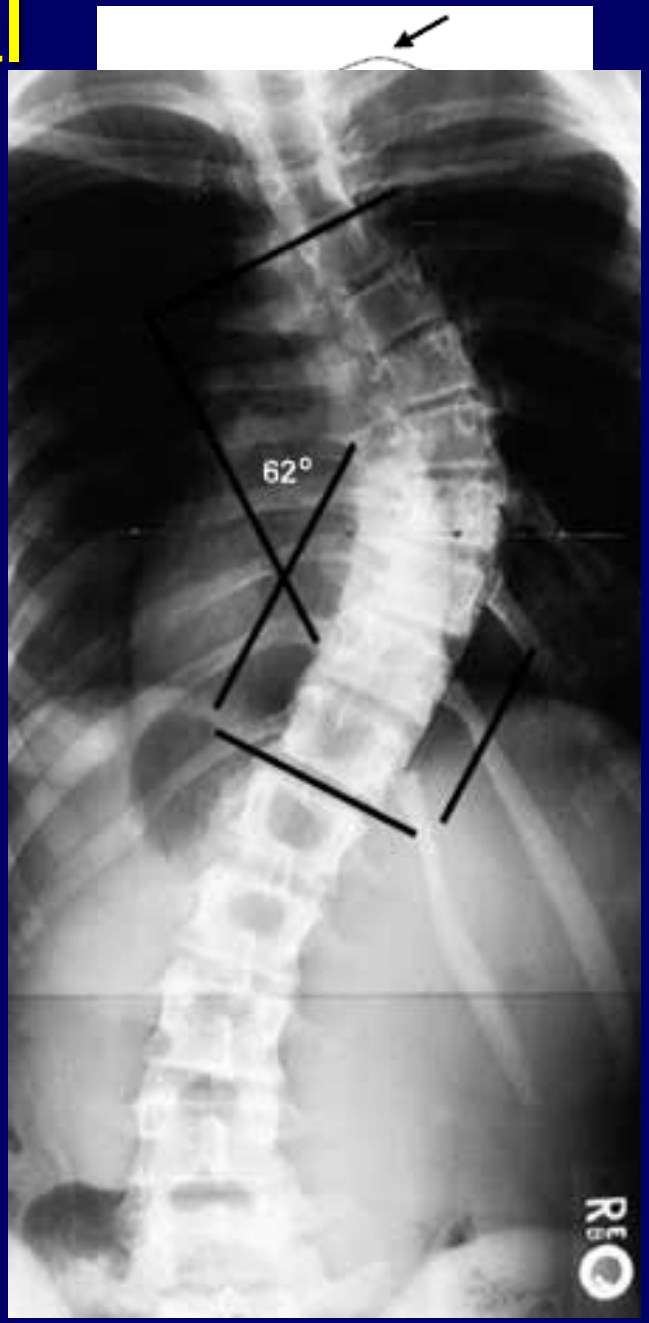
- Lateral curve of spine >10^{o}.
- Seen in 2-4% of kids 10-16 yrs.
  - Ratio of girls to boys 10:1 for curves >30^{o}.
  - Girls curves 10x more likely to progress.
- School based screening ? value (26 states require).
  - Screen girls twice: age 11 and 13
  - Screen boys once at 13-14.

Consequences of Scoliosis

- No greater incidence of back pain or arthritis long term.
- Curves <50^{o} unlikely to worsen.
  - >90^{o} in T-spine can affect lungs and heart.
  - L-spine can push abdominal contents against chest.
  - Cosmetic effects.
- Curve progression risks: female gender, larger curves, growth potential.

Scoliosis Eval

- Exam:
  - Signs: shoulder elevated, pelvis tilted, contour of flanks differ.
  - Forward Bend test – look for rib hump.
  - 90% curve to right (left curves need more evaluation - MRI)
- X-ray – standing 52” PA of full spine (Cobb angle).



Scoliosis - Management

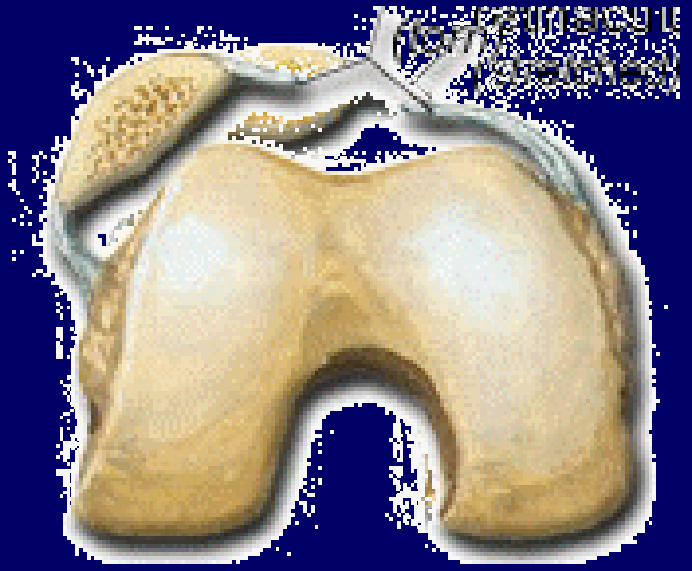
- Based in degree of curve and maturity. Goal is to keep curve <*50*^{o}.
  - 10-30^{o} – observe every 6 months, exam ± x-ray.
  - 30-45^{o} – consider *TLSO bracing* to slow progression (20 hrs/day).
  - ≥45^{o} – consider surgery.
- Benefits of brace or surgery questionable.

Patellofemoral Pain

- Spectrum of ant. knee pain.
  - Women thought to be at increased risk due to wider pelvis and increased Q-angle.
  - Flat feet, tight IT band and VMO dysplasia contribute.
- Symptoms: activity related anterior knee pain.
  - Worse on stairs or after prolonged sitting (Theatre sign).
  - Better with rest.

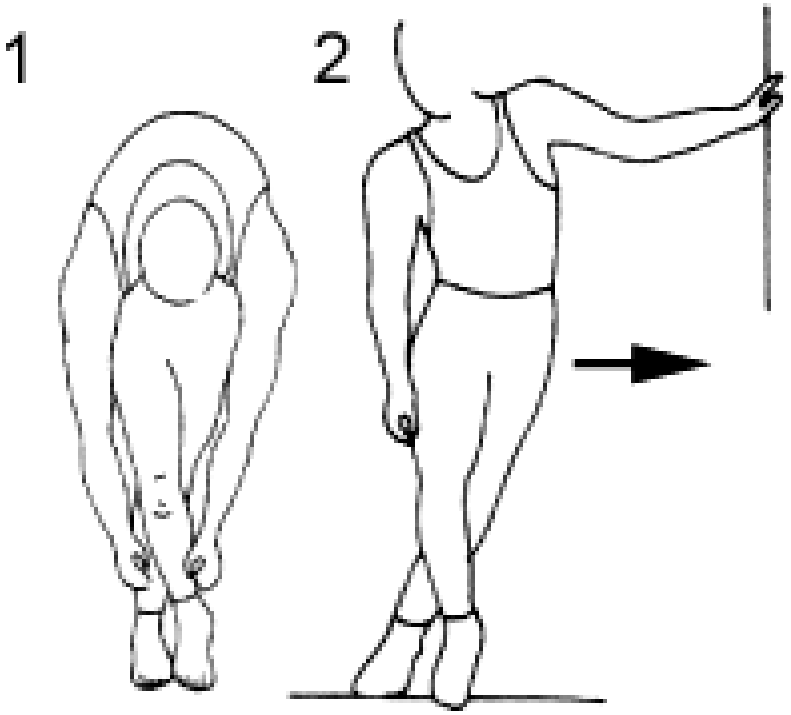
Patellofemoral Pain - Dx and Tx

- Exam: tender around and under patella.
  - May see crepitus, hyper-mobile patella, and J-sign.
  - Patella grind and apprehension (dislocation).
- Treatment: start with rest.
  - Rehab exercises.
  - Stretch IT band and achilles.
  - Orthotics, knee sleeve, taping.



Patello

- Butt Squeeze – h
  btw butt cheeks.
- *Quad leg raises* – hold
- *Terminal Knee knee ext.*
  supine with rolled towel
  knee, lift heel and hold.
- *IT Band Stretch* – stand on leg to be stretched, cross opposite leg over, lean toward crossed over leg.



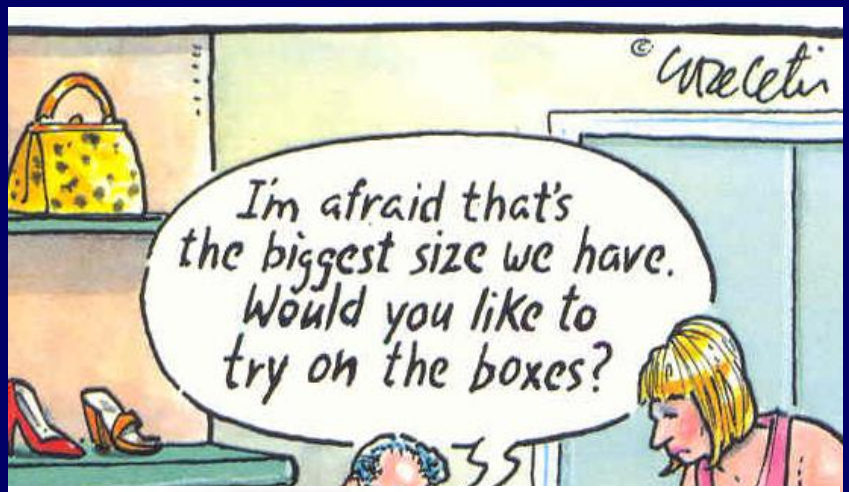
ILIOTIBIAL
BAND STRETCHES

Bunions

- Related to flat foot and hallux valgus deformity. Predisposes to shoe friction at MTP joint.
- Incidence 9x greater in women than men.
  - May be due to laxity or genetics. *Shoe-wear* is key.
  - Common in dancers, sprinters.
- Symptoms: pain, swelling, warmth, redness over medial 1st MTP. *May* be a/w hammer toe and callus.

Bunions - Treatment

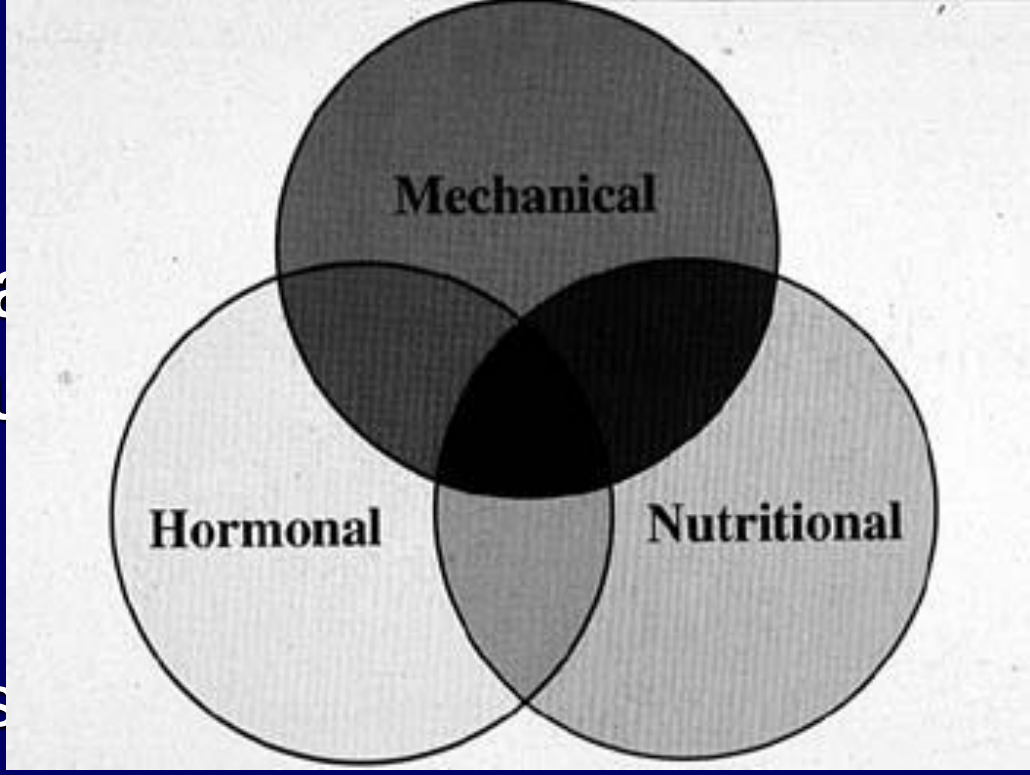
- Alter shoes: wide shoes, square toe box, soft material.
  - High-heels → flats.
  - Running shoe good.
- Arch supports if flat footed.
- Bunion *pads* and toe spacers.
- Surgery is last resort. Poor results in sprinters and dancers (stiffness).



Tips for Proper Shoe Fitting

- Buy shoes late in day (feet most swollen).
- Try on with socks you wear.
- Maintain thumbnail width btw longest toe and end of shoe.
- Fit shoes to larger foot.
- Compare tracing of standing foot with width of shoe – if > ¼”, shoe is too narrow.
- Re-check size – feet get longer and wider with age.

Stress



- Fracture due to repea
  - *Microfractures* occu
  - Peak age: 18 - 25.
  - Running causes vast
    10% of sports injuries
- Predisposing *factors*:
  - Physical activity: too much, too fast, too soon.
  - Female gender (3.5 X males): menstrual irregularity; biomechanics.
  - Nutrition: eating disorders; low calcium intake.

Stress Fractures - Diagnosis

- Symptoms: pain is 1º symptom.
  - Starts as a dull ache after training, then becomes more severe.
  - Localizes to fx site as it worsens.
- Exam: may see point tenderness, swelling and/or warmth.
  - Percussion or vibration over fracture site may elicit pain.
  - Stretching overlying muscle, tendon or ligament does NOT reproduce pain.

Radiographic Tests for Stress Fracture

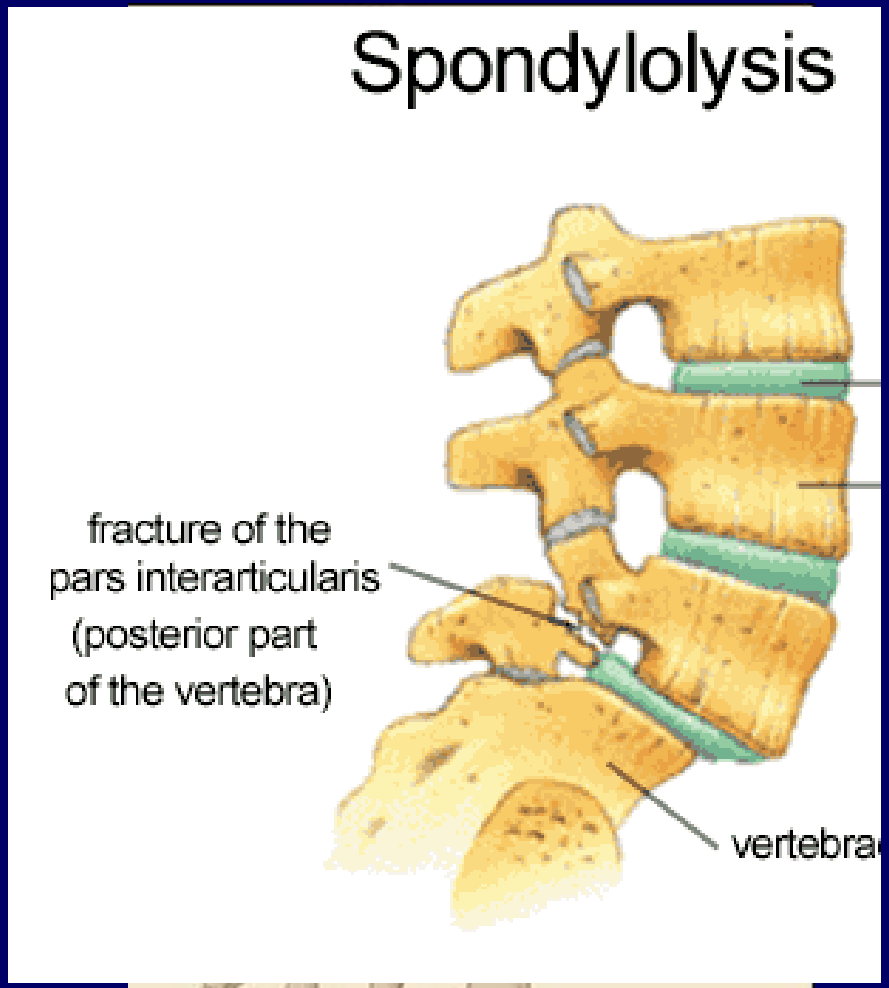
- X-ray diagnostic if shows fracture.
  - Up to 50% of x-rays never show.
  - May take up to 3 months.
- Bone scan is sensitive (pos. in 6-72 hrs, but not specific (infx, neoplasm, or infarction).
- MRI scan – sensitive like bone scan – also shows soft tissue. Useful in femoral neck fx.
- CT scan – useful to delineate fx (especially in pelvis and sacrum).

Stress Fractures
2 Stage Treatment Plan

- Stage 1: active rest, NSAID's, ice.
  - Alternate fitness activity.
  - Modify risk factors (flat feet, leg length deficit, footwear) and training regimen.
  - Supplement calcium and estrogen.
- Stage 2: start when pain free for 10-14 days.
  - Continue above activities.
  - Resume running on alternate days.
- Use pain as a guide to advance.

Problem Stress Fractures

- Anterior Tibia ("dreaded black line").
- Proximal 5th Metatarsal (Jone's Fx)
- Femoral Neck (groin pain).
- Tarsal Navicular (arch pain).
- Spondylolysis (LBP in teen).

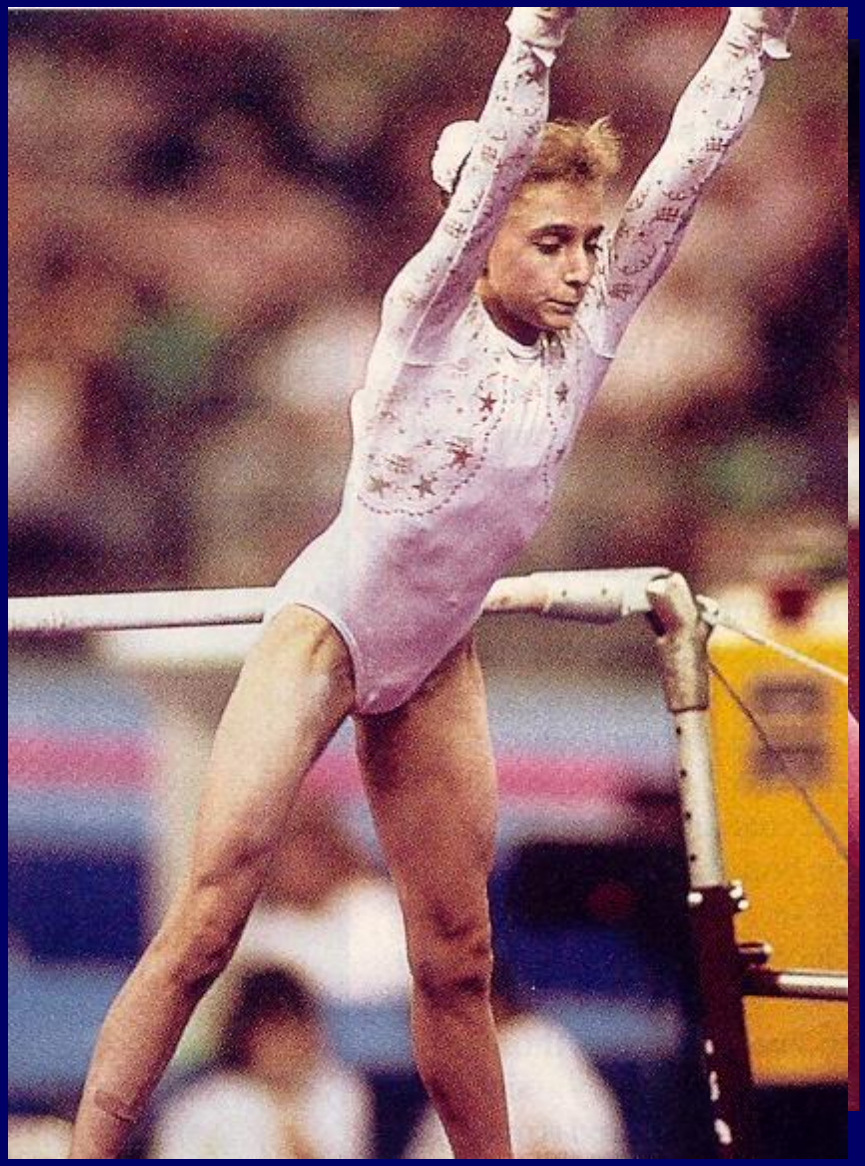


Female Athlete Triad

- Defined as:
  - Disordered eating
  - Amenorrhea
  - Early osteoporosis
- Controversial term – rare to see all 3 in same athlete.
  - Re-defined as “Syndrome of Low Energy Availability” or “Relative Energy Deficiency in Sports”; RED-S.
  - Underlying cause is energy imbalance; Also seen in men.

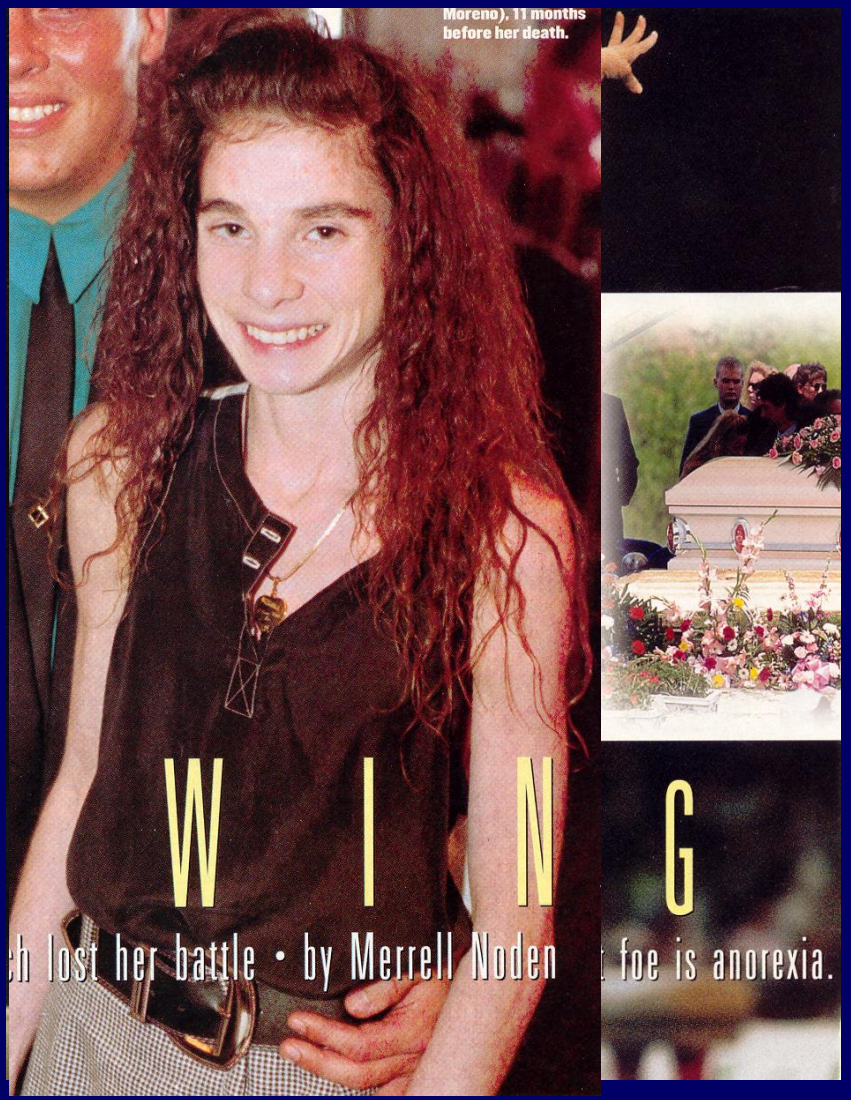
Evolution of Women's Gymnastics

- Average size of US Olympic team:
  - 1976: 5'3" 105 lbs.
  - 1992: 4'9" 79 lbs.
- 1964 – Vas Caslavska.
  - 5'3", 121 lbs.
- 1968 – Kathy Rigby
  - 4'11" , 94 lbs.
- 1972 – Olga Korbut.
  - 4'11", 85 lbs.
- 1992 – Shannon Miller.
  - 4'10", 72 lbs.



Christy Henrich

- World class gymnast.
- Peak of her career was 4’ 10”, weighed 95 lbs.
- 1988 judge remarked she needed to lose weight to make Olympic team.
- *Died* in 1994 at 22 from anorexia, her weight was 62 lbs (up from 47).



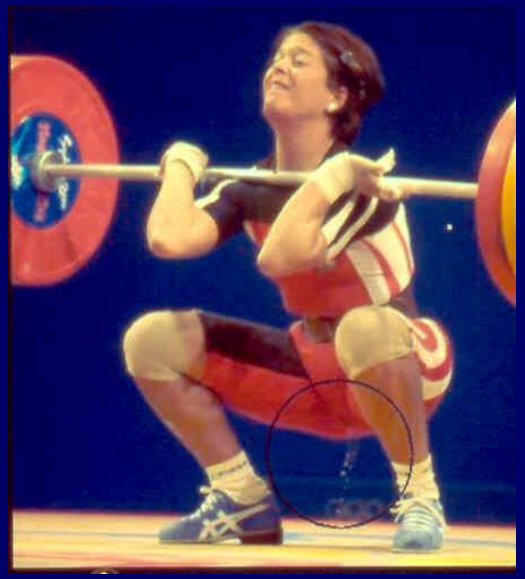
Simone Biles
4’ 8”; 104 lbs

Osteoporosis

- Peak BMD in late 20's - Lose .3-.5% per yr.
  - Those with 2^{o} amenorrhea lose 4% per yr.
  - Starting with higher BMD helps prevent loss below critical fracture threshold.
- Other factors can affect BMD:
  - Illness: thyroid, malnutrition, renal insuff, cancer, connective tissue dz.
  - Medication: corticosteroids, excess thyroid.
  - Diet and habits: malnutrition, low Ca, smoking, caffeine, Etoh, inactivity.

Stress Urinary Incontinence

- Involuntary loss of urine during physical exertion.
- More common with increased age and number of vaginal deliveries.
  - 47% of regularly exercising women have some degree of urine loss (mean age 38.5 yrs) .
  - 28% of nulliparous college athletes (mean 19.9 yrs).
- Many women do not discuss and may stop exercising.



Hyponatremia of Exercise

- Related to replacement of hypertonic sweat with a hypotonic fluid. Common in endurance races.
- Moderate (Na 126-130): malaise, nausea, fatigue, confusion. Pass dilute urine.
- Severe (Na <126): coma, seizures, “phantom running”, death.
- Risk Factors: females, slower runners.
- In 2002, Cynthia Lucero dies Boston Marathon and Hilary Bellamy dies Marine Corp Marathon .

2 Marathon Deaths from Hyponatremia in 2002

- Hilary Bellamy (Marine Corp Marathon)
  - October 22, 2002

- Cynthia Lucero (Boston Marathon)
  - April 15, 2002

- Both fit classic pattern.

Muscle Loss in Women

- Sarcopenia occurs to greater degree in women that men:
  - 15% per decade after age 50
  - 30% per decade after age 70
- Results in loss of strength:
  - Age 65; 45% women can't lift 10 lbs
  - Age 75; 65% women can't lift 10 lbs
- Resistance training results in a 25-100% improved strength in elderly women. (Jaffe; Am J Pub Health; 1981)

Conclusion

- Women's sports participation has dramatically increased since Title IX in 1972.
- Injury risk and patterns of injury in women are quite similar to men in like sports.
- Inherent gender differences allow for some unique concerns and disparate injury rates.
  - ACL tears show the most dramatic disparity.
  - Problems related to pregnancy and menstruation are entirely unique to women.
- None of these concerns should lessen enthusiasm for women's sports as benefits far exceed risks.