Disclosures

- Neither I, Rhonda Watkins, nor any family member(s), have any relevant financial relationships with a commercial interest to disclose.

Objectives

1. Discuss diagnosis and management of athletes with stress injuries
2. Recognize overtraining in athletes and other causes of fatigue
3. Discuss diagnosis and management of athletes with iron deficiency

Scenarios in Youth Sport

The football player, who, after a summer of inactivity, goes straight into a fall pre-season training camp

The swimmer who normally trains at 5000 yards per day but then is asked to swim 8000 yards a day for three consecutive days

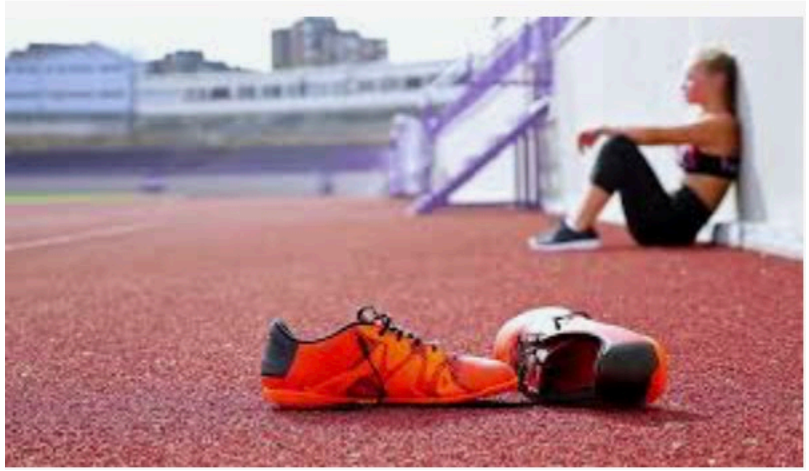
The dancer who does 12 hours of classes per week and then suddenly is training six hours per day, six days a week at a summer dance program

The gymnast, who, in the weeks before a major event, doubles her training time.

TOO MUCH TOO SOON

Introduction

- Nearly 60 million children & adolescents engage in organized sports yearly
- Training loads and competition schedules increase dramatically during adolescence
- **Overload** : balance between external load & internal load is altered so that the body's adaptive capacity is inadequate



Difiori et al BJSM 2014

What is Load?

- **External load:** total distance run, the weight lifted or the number and intensity of sprints, jumps or collisions
- **Internal load**: ratings of perceived exertion and heart rate
- **External load + internal load + individual athlete characteristics** (age, training age, injury history & physical capacity) **= training outcome**

Overload : balance between external load & internal load is altered so that the body's adaptive capacity is inadequate

Gabbett TJ, BJSM 2016

The Consequence..

Results in manifestations of altered performance and injury and/or illness:

- Stress injuries
- Dropout
- Burnout
- Overtraining
- Iron deficiency
- Iron deficiency anemia
- Depression
- Anxiety

Clinical Scenario 1

The dancer who does 12 hours of classes per week and then suddenly is training six hours per day, six days a week at a summer dance program

- *Now presents 4 weeks later with c/o b/l shin pain*
- *No swelling, color change or numbness*

Differential diagnosis?

Audience Response Question

All of the following are possible diagnoses except:

A Medial tibial stress syndrome

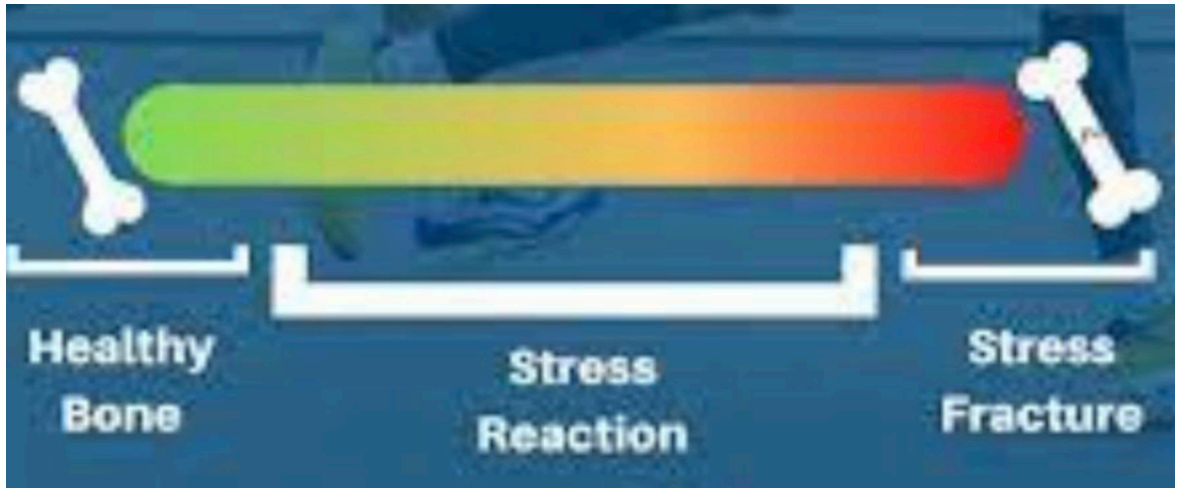
B Tibial stress fracture

C Compartment Syndrome

D Popliteal Artery Entrapment Syndrome

Medial Tibial Stress Syndrome

- Aka shin splints, MTSS
- An early stress injury in the continuum of tibial stress fractures
- ***Overload of tibial bone*** with associated periostitis
- 13.6% to 20% in runners and up to 35% in military recruits



McClure et al. StatPearls [2021

Medial Tibial Stress Syndrome

Presentation/Symptoms:

- Exercise-induced pain along the distal two-thirds of the medial tibial border
- pain provoked during or after physical activity, which reduces with relative rest
- Do not have cramping, burning pain over the posterior compartment &/or numbness/tingling in the foot

Exam:

- Pain with palpation of the posteromedial tibial border >5cm
- No swelling, erythema
- Normal pulses

Medial Tibial Stress Syndrome

Diagnosis

- Clinical diagnosis
- Imaging:
  - If concerned for a more significant tibial stress injury
  - X-rays: Negative in MTSS
    - "dreaded black line" if stress fracture may be negative early on
  - MRI: modality of choice
    - periosteal edema and bone marrow edema

Medial Tibial Stress Syndrome

Management:

- Rest and activity modification with less repetitive, load-bearing exercise
- Air cast stirrups
- Vitamin D lab and optimization
- Gait retraining
- Modalities? →No intervention has been proven to be superior for MTSS

Medial Tibial Stress Syndrome

0196-6011/82/0304-0183$02.00/0
THE JOURNAL OF ORTHOPAEDIC AND SPORTS PHYSICAL THERAPY

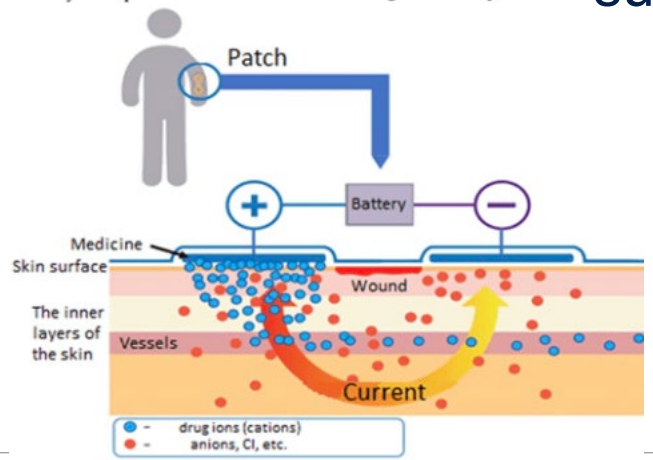
Iontophoresis for Treatment of Shinsplints*

FRED G. DELACERDA, PhD, RPT†

0196-6011/86/0802-0077$02.00/0
THE JOURNAL OF ORTHOPAEDIC AND SPORTS PHYSICAL THERAPY

Comparative Study using Four Modalities in Shinsplint Treatments*

WAYNE SMITH, MEd, PT, ATC,† F. WINN, PhD,‡ R. PARETTE, MPH, PT†



Iontophoresis was effective in the elimination of shin splint pain in all 18 cases of shin splints

Subjects in all treatment groups had reduced pain significantly more than the control group. However, no treatment was found to be superior to another treatment.

Winters et al. Sports Med 2013

Medial Tibial Stress Syndrome

Modalities: Radial Extracorporeal shockwave therapy (ESWT)

- Radial ESWT+ Standardized home training program VS standardized home program only in sports athlete population
- Radial ESWT weeks 2, 3 and 4 after the start of the 12-week home training program
- Radial ESWT + home program was found to improve severity of pain when compared with a home training program only

Winters et al. Sports Med 2013

Medial Tibial Stress Syndrome

Modalities: Focused Extracorporeal Shockwave Therapy (ESWT)

- The effect of a six-phase graded running program compared with the same running program with the addition of focused ESWT
- Five treatments of focused ESWT (weeks 1, 2, 3, 5 and 9)
- Time to full recovery was significantly faster in the ESWT group compared with the patients who only performed a graded running program

Winters et al. Sports Med 2013

Clinical Scenario 2

15 YO swimmer who normally trains at 5000 yards per day but then is asked to swim 8000 yards a day for three consecutive days

- *Frustrated that his times are not improving despite the increase in his yards*
- *Presents with complaints of fatigue*
- *Also been getting into fights with teammates*

Possible diagnosis?

Audience Response Question

Which of the following could be his diagnosis?

A Overtraining syndrome
B Iron deficiency
C Depression
D All of the above

Overtraining Syndrome

- Occurs when an athlete's training schedule is too much to allow for his/her body to recover
- Seen when the athlete is required to do too much - either physically or mentally, or both

Budgett. Br J Sport Med 1990

Overtraining Syndrome

- Slower times in distance sports such as running, cycling, and swimming
- Deterioration in execution of sports plays or routines such as those in figure skating and gymnastics
- Decreased ability to achieve training goals
- Lack of motivation to practice
- Getting tired easily
- Irritability and unwillingness to cooperate with teammates

Overtraining Syndrome

Risk Factors:

- Early single sport specialization
- Significant increase in training over a short period of time
- Training for an important event
- Excessive parental and/or coach pressure to succeed

Overtraining Syndrome

Presentation/Symptoms:

- Increased fatigue
- Decreasing performance
- Sleep problems
- Anxiety
- More frequent injuries
- Frequent illness
- Bradycardia or tachycardia
- Irritability
- Weight loss
- Depression
- Lack of mental concentration
- Vague muscle and/or joint pain

Overtraining Syndrome

Diagnosis:

- Athlete's current training schedule
- Dietary history
- Symptoms, current meds
- +/- screening labs

Overtraining Syndrome

Management:

- Rest for 3-5 weeks
- Gradual return to full training over additional 3 months
- Non-competitive, low level recreational physical activity OK
- Psychotherapy and counseling may also be prescribed as part of the treatment

Overtraining Syndrome

Prevention:

- Training log
- Avoid intense exercises with short rests, and frequent competition
- Avoid sudden increases in training load
- Steady increase of 5% intensity per week
- Emphasize skill development not winning for younger athletes

Could his fatigue be more?

Clinical scenario 2 continued…

15 YO swimmer who normally trains at 5000 yards per day but then is asked to swim 8000 yards a day for three consecutive days

- He says his coach told him to ask for a ferritin check
- Says maybe he could take some vitamins or something to help

Lab Work?

Iron deficiency

- Transport and delivery of oxygen
- Energy production in mitochondria
- Cognitive function
- Immune Function

Iron deficiency
Iron deficiency non anemia
Iron deficiency anemia

- **Tiredness**
- **Lack of energy**
- **Diminished athletic performance**
- **Poor recovery**
- Shortness of breath
- Palpitations

Iron deficiency

- **Iron deficiency**, or in severe cases, anemia, can be detrimental to athletic performance and overall health
- High frequency of iron deficiency without anemia in trained athletes, particularly female runners
  - 15% - 35% in female athletes and 3% - 11% in male athletes
- No consensus on level of iron deficit that will negatively affect exercise performance, indications for iron treatment

Rowland T. *American Journal of Lifestyle Medicine*. 2012

Iron deficiency

Risk Factors:

- **High intensity and endurance exercise** due to loss from heavy sweating, blood loss in the urine and GI tract and exercise-related decrease in iron absorption
- **Endurance running** due to RBCs destruction from mechanical force of a foot strike
- **Females** due monthly blood loss associated with menstruation
- **Strict vegetarian or vegan diet** due to the decreased absorption of non-heme iron found in plants and fortified foods
- Low iron intake from **low energy availability** e.g. RED-S

Kuwabara et al. PM&R20202
Rowland T. *American Journal of Lifestyle Medicine*. 2012

Iron deficiency

Diagnosis:

- Ferritin less than 15 ng/mL considered diagnostic for iron deficiency
  - For athletes Ferritin <35 ng/mL suggested as lower limit of normal
- Most labs report the normal ferritin range between 15-150 ng/mL for females and 15-300 ng/mL for males
- Hemoglobin normal Hb] >12 g/dL females, >13 g/dL males

Kuwabara et al. PM&R20202.

Iron deficiency

Diagnosis:

- History
- Lab work: hemoglobin, hematocrit, ferritin, and iron
  - CBC, iron, ferritin, transferrin, TIBC
- Routine screening for ID and IDA in female athletes and male endurance athletes is often recommended

TABLE 2 Iron screening guidelines for athletes

Annually	Biannually	Quarterly
• No history of iron deficiency or irregular menstruation • No symptoms of fatigue or low energy availability • Non-endurance sports • No dietary restrictions affecting iron intake • No planned altitude exposure • No underlying gastrointestinal pathology	• Female • Prior history of iron deficiency (stage 1) or irregular menstruation • Endurance sports • Symptoms of fatigue without impairment of performance • Plan for altitude exposure in next 12 months • No dietary restrictions affecting iron intake or signs of low energy availability	• Prior history of iron deficiency (stage 2 or 3) or irregular menstruation • Endurance sports • Symptoms of fatigue with performance impairment • Dietary restrictions affecting iron or overall calorie intake • Any evidence of low energy availability • Plan for altitude exposure in next 6 months

Kuwabara et al. PM&R20202.

Iron Deficiency

Management:

- Increase intake of iron-rich foods: red meat, chicken, and fish, iron-enriched cereals and pastas, beans, and dark-green leafy vegetables

TABLE 4 Heme and non-heme foods – based on USDA food composition database

Heme iron foods	Iron content (mg per 3 oz serving)
Clams	23.8
Liverwurst	8
Chicken Liver	8
Oysters	7.8
Beef Liver	5.8
Mussels	5.7
Venison	2.8
Extra Lean Ground Beef	2.5
Sardines	2.4
Lamb Chop	2.1
Non-heme iron foods	**Iron content (mg per serving)**
Soybeans (cooked)	8.8 (1 cup)
Blackstrap Molasses	7.2 (2 tbsp)
Lentils (cooked)	6.6 (1 cup)
Spinach (cooked)	6.4 (1 cup)
Tofu	6.4 (4 oz)
Bagel (enriched)	6.4 (1 medium)
Chickpeas (cooked)	4.7 (1 cup)
Tempeh	4.5 (1 cup)
Lima Beans (cooked)	4.5 (1 cup)
Black-eyed Peas (cooked)	4.3 (1 cup)

Kuwabara et al. PM&R20202.

Iron Deficiency

Management:

- Iron supplementation for athletes with hypoferritemia (ferritin <12-20 ng/mL) w/o anemia
- Oral (ferrous sulfate, ferrous gluconate: pill, liquid)
  - 100 mg of elemental iron daily for 2 to 3 months (two 325-mg ferrous sulfate tablets contain 130 mg elemental iron)
  - Supplement until ferritin of 50
- Studies have shown that 100 to 200 mg of elemental iron on Mon, Wed, and Friday may result in equivalent or better absorption

Rowland T. *American Journal of Lifestyle Medicine*. 2012
Kuwabara et al. PM&R20202.

Iron Deficiency

Management:

- Orange juice (without calcium) + supplement
- Do not take with milk, coffee, calcium tablets, PPI's as these can reduce the absorption of iron
- gastrointestinal side effects (diarrhea, cramping) and can theoretically interfere with absorption of other minerals, such as zinc and copper
- Can cause constipation, so increase dietary fiber intake

Key Points

- Youth athletes are increasing at risk for Overload
- Overload can increase their risk for manifestations of altered performance, injury and/or illness
- Screening in high-risk populations like female athletes, endurance athletes can improve diagnosis and treatment for ID, decrease transition to IDA
- Gradual increase in training and competition schedules can help prevent overloads and resulting associated injury

Our bodies can to anything if we give it time to! adapt

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Thank You!

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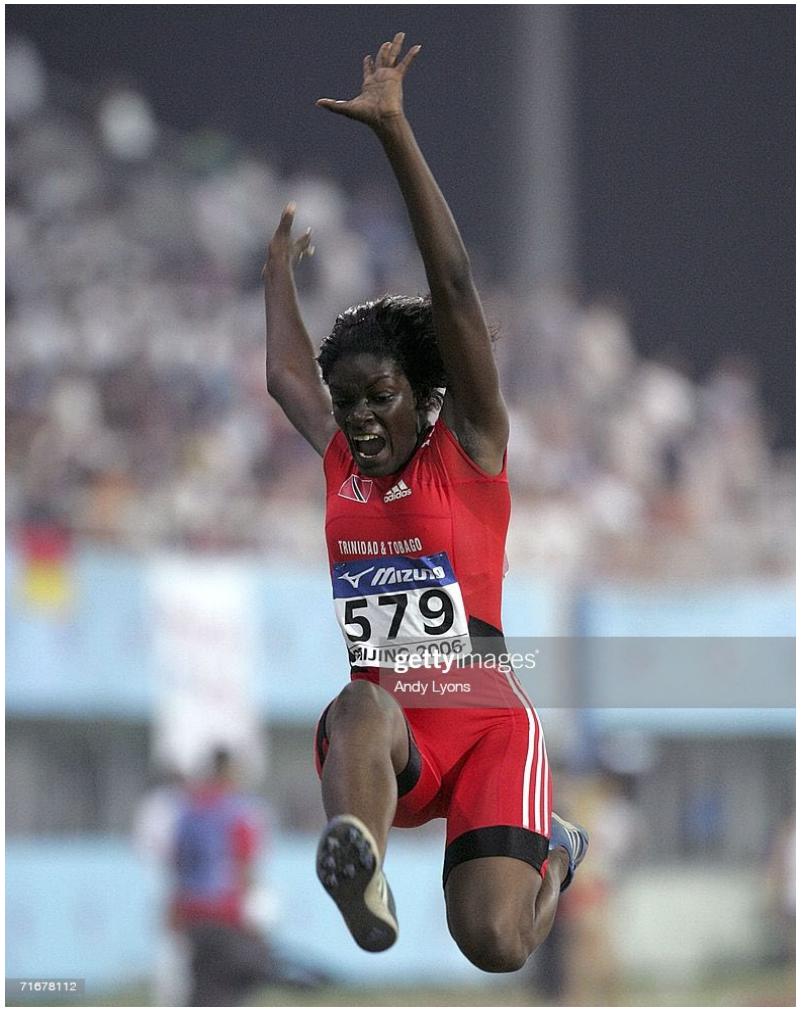

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